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GENERAL

17577 AECL-856
Atomic Energy of Canada Ltd., Ottawa.
ANNUAL REPORT FOR 1958–1959. 30p.

Activities at AECL for the year ending March 31, 1959, are summarized. Nuclear power program effort was directed at NPD-2, CANDU, OCDRE, and small enriched fuel plants. Research and development in biology, medicine, high-energy physics, and reactor physics are summarized. Other reports are given on: industrial participation, commercial products, international cooperation, finance, and administration and personnel. (T.R.H.)

17578 ALI-52
Little (Arthur D.) Inc., Cambridge, Mass.
RADIATION: A TOOL FOR INDUSTRY. A Survey of Current Technology. Jan. 1959. 414p. For Emerson Radio and Phonograph Corp. and General Electric Co. Hanford Atomic Products Operation. Contracts AT(49-10)-1458 and W-31-109-Eng-52. $5.50(OTS).

This one-year survey of industrial applications of ionizing radiation is based on interviews with workers in the field and on analysis of selected literature. Ionizing radiation at kilowatt power levels from electron accelerators and from radionuclides is finding a few special applications, notably sterilization and polymerization. Ten new processes have been found to be in various stages of process development and testing. These are concentrated heavily in the plastics field, though examples are found in petrochemical synthesis, product sterilization, and portable energy sources such as batteries. Ionizing radiation is not yet a processing tool of major importance to industry generally, however, because it has not yet demonstrated sufficient advantages over established methods of achieving a similar result. Thus, though ionizing radiation produces free radicals under a wide variety of conditions, it has, with few exceptions, not proved superior to other agents, such as heat and chemicals, that also produce free radicals. Insufficient specificity of action, low yields, and costs higher than those of competitive processes are among the chief difficulties found. Possible unique features of radiation have not been fully explored. Optimization of environmental variables has not been thoroughly studied. Indirect advantages associated with radiation, such as greater processing or packaging flexibility, have already proved significantly important but have not yet been thoroughly evaluated in most potential applications. Even radiation engineering is relatively undeveloped and radiation economics uncertain. Skillfully oriented research and development on such problems will improve the likelihood of radiation becoming a tool of major importance for U. S. industry. (auth)

17579 ITR-1702
Stanford Research Inst., Menlo Park, Calif.
EARTH MOTION MEASUREMENTS. PART I. SEISMIC STUDIES AND CAVITY STUDIES. Preliminary Report. L. M. Swift, D. C. Sachs, and W. M. Wells. Jan. 1959. 58p. Project 26.1 [of] OPERATION HARDTACK II. $1.75(OTS).

Several parameters were measured of ground motion caused by two deep underground nuclear detonations (Evans and Blanca). Primary measurements included vertical acceleration and velocity in a deep hole over Evans zero, horizontal and vertical acceleration on the mesa surface, and horizontal surface strain. On Evans, only one half of the electronic gage records were useful, and no cork-wire or reed gage data were obtained due to the low yield. Vertical acceleration in the Evans deep hole was one-tenth or less than that predicted. Peak horizontal components of surface acceleration exceeded the vertical, suggesting that much of the blast energy in earth was channeled into rock layers near the surface. Geophone arrival times gave average velocities of 6000 to 7200 ft/sec, consistent with those expected for tuff. On Blanca, limited data were obtained from vertical accelerometers reactivated in the Evans deep hole. Accelerations measured on the mesa surface on Blanca showed vertical maxima consistently larger than the horizontal. Surface strain data indicated that much of the blast energy was refracted or reflected from subsurface layers. Reed gage data indicated that the vertical response spectrum shifts to low frequencies with increasing distance from the burst. (auth)

17580 SCTM-186-57(51)
Sandia Corp., Albuquerque, N. Mex.
BLAST AND FALLOUT PREDICTION UNITS—OPERATION PLUMBBOB. Jack W. Reed. May 1, 1957. 12p. Contract AT(29-1)-789. $3.30(ph), $2.40(mf) OTS.

Preparations are discussed for the prediction of blast and fall-out during the Nevada Test Site shots of Operation Plumbbob. Operating procedures and instruments are described. (C.H.)

17581
SOVIETS STUDY NUCLEAR PLANE CONCEPTS. J. S. Butz, Jr. Aviation Week 71, No. 2, 65, 67(1959) July 13.

The various proposals the Russians have under consideration for nuclear-powered aircraft are discussed. (T.R.H.)

17582
RADIOCHEMICAL FACILITIES FOR HIGH ACTIVITIES. Miloš Weber. Jaderná energie 5, 184-9(1959). (In Czech.)

A survey is given of the progress achieved in the design and construction of apparatus for remote control and of the prospects of further development of the radiochemical facilities for high activity materials, as it has been rendered by the communications and reflected by exhibits at the Second International Conference on Peaceful Uses of Atomic Energy in Geneva 1958. (auth)

17583

MEASUREMENT OF SINGLE PARTICLES IN CLOUDS FROM ATOMIC RESEARCH EXPERIMENTS. A. Sittkus (Universität, Freiburg i. B). Naturwissenschaften 46, 399(1959). (In German)

Three large particles were found on air filters at Freiburg for samples collected on Nov. 20 and 21, 1958. The β activities were 3.2, 0.63, and 0.67; the γ activities were 4.0, 0.71, and 0.52 (all in mμc). The activity of the rest of the filter was: 2.7 and 4.1 (same units). The results of the measurements show that the active single particles occurring in bomb clouds do not exhibit the normal fission-product composition. This is understandable on the assumption that their production results directly in the explosion by condensation of fission products, during which the different volatility of the component elements and the partial formation of long-lived isotopes versus volatile short-lived intermediates plays an important part. (T.R.H.)

17584

THE PLOWSHARE PROGRAM—A CHALLENGE TO NON-DESTRUCTIVE TESTING. David D. Rabb (Univ. of California, Livermore). Nondestructive Testing 17, 211-14(1959) July-Aug.

The industrial uses of nuclear explosives, the possible applications, results of recent underground tests, the current status of Plowshare projects, the suspected phenomenology and sequence of events during an explosive release of nuclear energy underground, and the radioactivity associated with such an event are reviewed. It presents a challenge to all non-destructive engineers to predict and later define and describe the results of employing this novel energy source under the surface of the earth. (auth)

17585

THE ITALIAN NUCLEAR PROGRAM SINCE THE SECOND GENEVA CONFERENCE. F. Ippolito (Comitato Nazionale per le Ricerche Nucleari, Rome). Nuovo cimento (10) 11, Suppl. No. 3, 419-29(1959). (In Italian)

A survey of the Italian nuclear program is presented. The progress in the discovery and exploitation of uranium ores, the processing of uranium minerals, the planning and construction of reactors, and the industrial applications of nuclear energy are briefly reviewed. (J.S.R.)

17586

GAMMA RADIATION IN RESEARCH AND INDUSTRY. [PART] I. Otto F. Joklik (Transcontinental Atomic Co., Lugano, Ger.). Prak. Chem. 10, 99-102(1959) Mar. (In German)

A review is presented on the use of gamma radiation in research and industry. The characteristics of a Co^{60} source, the most used gamma source, are discussed in order to indicate the reasons for its wide-spread use. In addition to its use in radiation therapy, gamma radiation is of value in the chemical, plastic, rubber, and petroleum industries, pharmaceutical industry, food sterilization and preservation, and measurement and control technology. The application in the chemical industry is briefly discussed. (J.S.R.)

17587

GAMMA RADIATION IN RESEARCH AND INDUSTRY. II. Otto F. Joklik (Transcontinental Atomic Co., Lugano, Ger.). Prak. Chem. 10, 134, 136-8, 140, (1959) Apr. (In German)

The review on the use of gamma radiation in research and industry is concluded with a consideration of the pharmaceutical and food industries, and measuring and control techniques. Complete irradiation facilities are briefly considered. (J.S.R.)

17588

He^3–H^3 RADIATION AGE OF A STONE METEORITE. F. Begemann, P. Eberhardt, and D. C. Hess (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). Z. Naturforsch. 14a, 500-3(1959) May-June. (In German)

The tritium and He^3 contents of three samples of the ABEE stone meteorite have been measured. Within the experimental limits of error both are found to be the same at the surface and near the center of the meteorite. At the time of fall (1952) the tritium activity was (0.26 ± 0.04) disintegrations/min g. The He^3 content was measured to be $(0.13 \pm 0.01) \times 10^{-6}$ cc STP/g. The amount of He^3 accumulated and the tritium decay rate yield a maximum radiation age of 30 million years. If it is assumed that equal amounts of He^3 and H^3 are produced by the interaction of cosmic rays with the meteoritic matter, the radiation age is 13 million years. The He^4/U-age of the meteorite is greater than 3800 million years. The possible significance of this discrepancy is discussed. (auth)

17589

PROCEEDINGS OF THE SEVENTH HOT LABORATORIES AND EQUIPMENT CONFERENCE, PUBLIC AUDITORIUM, CLEVELAND, OHIO, APRIL 7-9, 1959. New York, Engineers Joint Council, American Society Mechanical Engineers, 1959. 469p.

Fifty-six papers are presented on recent innovations in equipment for radiation laboratories and in laboratory facility design. Separate abstracts have been prepared on the papers presented. (C.H.)

17590

THE DESIGN, CONSTRUCTION, AND EQUIPMENT OF THE NEW COMPONENTS DEVELOPMENT HOT CELL FACILITY AT ATOMICS INTERNATIONAL. J. M. Davis and B. H. Webb (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.1-18 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A facility was designed and built to permit the evaluation of irradiated reactor components. The design provices sufficient cell space to accommodate the disassembly of large objects such as entire control rods, and equipments for evaluation by such methods as materials testing and metallography. Provision is made for the operation of all cells under inert atmosphere, and for the handling of large quantities of materials emitting a mixture of high level alpha and gamma radiations. The facility is adequate for use on all presently-contracted fuel element and other reactor component development programs, and is sufficiently versatile to permit evaluation in future development programs. (C.H.)

17591

LABORATORY FOR NUCLEAR RESEARCH BY A PETROLEUM COMPANY. J. R. White, E. O. Guernsey, and R. W. Laferty (Socony Mobil Oil Co., Inc., Paulsboro, N. J.). p.19-30 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A new laboratory, featuring a 10^6 curie-level hot cell of unusual design, is described. The laboratory contains, in addition to the hot cell, a Van de Graaff accelerator, radiotracer and hot laboratories, cold chemical laboratories, and a physics laboratory. The hot cell is loaded and unloaded through a top access door. Radioactive materials are unpackaged and stored under a water shield in the bottom section of the cell. These may then be moved on an elevator up through the water shield to a work table, all parts of which are within reach of remote manipulators and within view through a window. Sealed sources or dispersable materials can be handled. For large shipping cask unloading operations or for decontamination, the hot cell may be flooded to the top with water. This water circulates to storage tanks, a purification system, or a waste disposal concentrator. A dry-irradiation space communicates with the hot cell through a gamma port. Experiments can be set up in this space to make use of the gamma radiation emanating from sources in the hot cell. The costs of the laboratory and its various parts are tabulated. (auth)

17592

HIGH-LEVEL RADIOCHEMISTRY FACILITY. R. W. Dascenzo and K. H. Hammill (General Electric Co., Richland, Wash.). p.31-40 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A facility is now under construction which will be used for chemical research and experimentation with highly radioactive materials. A description of the physical layout of the cells is presented. Some of the different cell features, such as the methods of handling highly radioactive liquid and solid samples, are described. The administrative aspects of construction and the construction costs are discussed. (auth)

17593

DESIGN OF AN INDUSTRIAL RADIOISOTOPE LABORATORY. E. W. Coleman, D. T. Green, and L. Van Gelderen (Picker X-Ray Corp., Cleveland). p.41-54 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The isotope laboratories of the new Picker Research Center are described, with special emphasis on design and construction for industrial research and production. The facilities include a hot cell, source storage room, and high and low-level radiochemical laboratories. Several design innovations, including an all copper zinc bromide window, a rotary cell crane, a 40 ton hinged cell door, and a square-tube storage garden are discussed. Preliminary results of operational tests are included. (auth)

17594

A PORTABLE HOT LABORATORY. E. Mestre, S. Trouve, and R. Rapin (Commisariat a l'Énergie Atomique, Saclay, France). p.55-70 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A self-contained hot laboratory enclosure which can be disassembled and erected in a short time is described. Also, some of the equipment and operating procedures are reviewed. (C.H.)

17595

BUILDING OF A FACILITY FOR THE HANDLING OF KILOCURIE AMOUNTS OF GAMMA EMITTERS. Ph. Germond (Centre d'Etudes Nucléaires, Saclay, France). p.71-80 in the "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A hot cell designed to handle up to 1000 curies of cobalt-60 has been built in a preexisting shielded room, in order to make optimum use of available space. Heavy containers can be rolled in or out of the cell. Handling is performed with two manipulators. One of them is pneumatically operated and the other one is mechanical. (auth)

17596

INTERMEDIATE LEVEL RADIOCHEMISTRY HOT CELL. Philip F. Moore (Los Alamos Scientific Lab., N. Mex.). p.81-6 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The general design and systems layout of a radiochemistry hot cell is described. Design criteria included an unusually high degree of flexibility and versatility in operations with minimum set-up times and a control layout such that no special operators need be used. Rigid contamination control was also required as well as adherence to a modest construction budget. (auth)

17597

LOW COST 100 CURIE FACILITIES. A. J. Gawin and R. A. Blomgren (Argonne National Lab., Lemont, Ill.). p.87-96 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Two 100 curie shield facilities have been designed with the objective of minimum cost with minimum utilization of floor space. The design is different from the usual in that the shielded door is a part of the front operating wall. This type of construction permits location of cells against blind walls or back-to-back configuration. Some actual construction costs are listed. Auxiliary apparatus such as the filter change equipment, source storage, and inter-cell transfer drawers are described. Ventilation control, decontamination, and waste disposal procedures are also discussed. (auth)

17598

THE GEORGIA NUCLEAR LABORATORIES. R. A. Thompson, C. E. Vivian, and L. A. Williams (Lockheed Aircraft Corp., Marietta, Ga.). p.97-108 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The Georgia Nuclear Laboratories presently being placed in operation by Lockheed for the Air Force will provide a capability to determine the needs for the development of nuclear aircraft. The primary objective is to experimentally conduct dynamic proof testing of nuclear aircraft subsystems and components under conditions of realistic flux and environment. The nuclear environment present in a nuclear powered manned aircraft places an additional burden on the initial design and maintenance phases of the aircraft. A conceptual view is presented of the Georgia Nuclear Laboratories which are currently under activation by Lockheed for the United States Air Force. (auth)

17599

FUEL ELEMENT EXAMINATION FACILITY FOR THE PLUTONIUM RECYCLE TEST REACTOR(PRTR). W. S. Kelly (General Electric Co., Richland, Wash.). p.109-19 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A facility is described which will permit the examination, immediately upon discharge, of fuel elements and process tubes irradiated in the Plutonium Recycle Test Reactor (PRTR). Located in the floor of the reactor hall, the facility will be provided with optical equipment to view, photograph, and measure the fuel elements and process tubes, and handling equipment to move the ele-

ments past the viewers. Directed air-cooling through the fuel element cooling channels will be provided to prevent damage resulting from self heating during examination. (auth)

17600

GAMMA-RAY INDUCED ELECTRICAL DISCHARGE IN A RADIATION SHIELDING WINDOW. Vaughn Culler (Corning Glass Works, N. Y.). p.120-8 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

An electrical discharge of a dry type radiation shielding window was accidentally produced during the cleaning of a hot cell. A brief analysis showing how gamma-irradiation of a dielectric material can produce the large electric fields needed for breakdown is given. A discussion of measurements on mock-up windows includes estimations of the irradiation time, dose, and the geometrical configuration needed for the electric field buildup. The resting time needed for decay of the field is also discussed. Other measurements show that similar discharges can be produced in many glasses and other dielectric materials. (auth)

17601

MEASUREMENTS THROUGH A HOT CELL WINDOW USING OPTICAL TOOLING. A. A. Abbatiello (Oak Ridge National Lab., Tenn.). p.129-38 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Optical tooling was evaluated for the measurement of physical dimensions of radioactive parts through hot cell windows. Instruments were set up outside a four-foot-thick lead glass window. Although the window was not specially selected, the readings were within 1.0% of the true dimension. Use of a calibration chart of the window variations reduced the error to ±0.1%. The method is considered feasible and sufficiently fast for a wide range of hot cell measurements. The reflections of a point light source from the lead glass laminates form a convenient indicator of the window's measurement qualities. (auth)

17602

THE KAPL STATIC CORROSION TEST FACILITY. W. F. Niebuhr (Knolls Atomic Power Lab., Schenectady, N. Y.). p.139-44 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The new KAPL static corrosion test facility used to determine the corrosion resistance of radioactive materials at elevated temperatures is described. The facility described consists of individual shielded autoclaves, designed and arranged to perform the required tests efficiently and with maximum safety to personnel. (auth)

17603

EQUIPMENT FOR THE MICROSCOPIC OBSERVATION OF RADIOACTIVE MATERIALS. R. L. Seidenberg (Bausch and Lomb Optical Co., Rochester, N. Y.). p.145-52 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Several modifications of microscopes which permit the use of a shielding barrier between the radioactive specimen and the observer are described. The use of non-browning glasses in the optical components of these microscopes is also considered. (auth)

17604

THE P.R.E. LIGHTING INSTALLATION. George Gustovich (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.153-62 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The Processing-Refabrication Experiment (PRE), proposed by Atomics International is a large-scale engineering experiment directed toward development of low-decontamination methods for processing irradiated uranium fuel. The development of processing techniques and equipment, remote handling techniques and equipment, and the associated shielded facility have been pursued concurrently. In order to permit visual control of equipment and materials through a viewing window, whose shielding capacity is equivalent to 11 inches of lead, a very large amount of in-cell light must be provided. Associated with this light input is a large amount of radiant heat which raises the ambient cell temperature to an undesirable level. In-cell cooling, in addition to that provided for removing furnace heat, is necessary to maintain an acceptable cell temperature. The operating requirements which were specified for a lighting system installed in the PRE hot cells include provision of adequate diffuse lighting with minimum glare in the eyes of the operator, the ability to control the ambient temperature of the inert-cell atmosphere to acceptable levels, a maximum stability toward radiation damage, elimination of any potential diffusion of atmosphere between the hot cell complex and the operating galleries, and maintenance and/or replacement of either the lighting assembly or any of its components without necessitating any in-cell contact operations. (auth)

17605

DESIGN CRITERIA FOR HEAVY-DUTY MASTER-SLAVE MANIPULATOR. Demetrius G. Jelatis (Central Research Labs., Inc., Red Wing, Minn.). p.163-8 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Consideration of some limitations of existing master-slave manipulators leads to the formulation of criteria for heavy-duty manipulators incorporating the salient features of the master-slave principle, in particular force-reflection and bilateral compliance. Force multiplication is introduced to reduce operator effort, combined with automatic indexing to allow full coverage of the hot area. (auth)

17606

RECTILINEAR MANIPULATOR BNL MODEL 4. L. G. Stang, Jr. (Brookhaven National Lab., Upton, N. Y.). p.169-76 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A new all-mechanical rectilinear manipulator is described. Operation of this manipulator is identical to that of the presently used BNL Model 3 Rectilinear Manipulator. However, the slot in the front shielding wall through which the bridge of the Model 3 Manipulator passes has been eliminated by converting all motions to rotary motions and transmitting them through the front wall by means of rotating drive shafts located at the ends of the bench or hot cell. This feature prevents the escape of scattered radiation or contamination and permits use of the manipulator in a totally sealed cell in which an inert atmosphere might be maintained. (auth)

17607

FRENCH MASTER SLAVES. P. Pesenti and G. Chérel (Commissariat a l'Énergie Atomique, Saclay, France). p.177-82 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The manipulators designed and built at Saclay are de-

scribed briefly. These manipulators are prototypes and are used in experimental work. A detailed description is not given, but their main characteristics are outlined. (auth)

17608

MACHINES AND TOOLS FOR USE AT THE WEST MILTON FUEL SERVICE FACILITY. B. B. Biggs (Knolls Atomic Power Lab., Schenectady, N. Y.). p.186-98 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The machines and tools used in the underwater operations at the West Milton Fuel Service Facility are discussed. The individual and over-all costs are reviewed, and the purposes and design features of the equipment are described. (auth)

17609

DRY STORAGE FACILITY FOR IRRADIATED MATERIAL. S. O. Lewis and S. E. Dismuke (Oak Ridge National Lab., Tenn.). p.199-206 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A shielded dry storage facility for storing canned radioactive materials is described. There are two hundred cylindrical receptacles, 6-½ inches inside diameter by 40 inches deep, which receive the 6-inch diameter storage cans. A remotely operated manipulator is used for transferring the canned materials in and out of this storage facility. (auth)

17610

CREEP TEST FACILITY FOR IRRADIATED SAMPLES. Robert F. Stearns (Knolls Atomic Power Lab., Schenectady, N. Y.). p.207-12 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A creep test facility has been developed to test irradiated samples with the same accuracy which can be obtained from non-irradiated samples. The facility provides for environmental temperatures up to 1200°F. Sample elongation is indicated directly by means of dial gages. The facility consists of a shielded cask containing a furnace, grips and load members, remote handling fixtures and a temperature control system. Successful tests have been made. (auth)

17611

THE DESIGN AND OPERATION OF A COMBINATION WET CUTOFF WHEEL AND MILLING MACHINE. E. C. Lusk and R. F. Burian (Battelle Memorial Inst., Columbus, Ohio). p.214-18 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

In preparing irradiated specimens for examination, a number of cutting operations are required. Ideally these operations can best be performed by an abrasive cutoff wheel; however, the use of such a device in a hot cell normally involves special problems in operation and decontamination. Battelle has designed a combination abrasive cutoff wheel and milling cutter which provides satisfactory performance with a minimum of decontamination problems. This equipment is basically a modified standard Clausing vertical milling machine. The listed costs and performances attest to the versatility and economy of the unit. (auth)

17612

THE USE OF COMMERCIAL EQUIPMENT FOR ANALYTICAL CHEMISTRY BY REMOTE CONTROL. J. J. McCown, W. R. Sovereign, and R. P. Larsen (Argonne National Lab., Lemont, Ill.). p.219-26 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Analytical operations, which will be used in the EBR-II Analytical Junior Cave Facility, have been tested in a full-scale cave mock-up. It has been found that all of the necessary operations can be performed using simple and in most cases commercially available equipment. A description of the operations and equipment is given. (auth)

17613

MAGNETIC COUPLINGS FOR TOTALLY SEALED SYSTEMS. A. Oltmann (Brookhaven National Lab., Upton, N. Y.). p.229-31 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A means of transmitting rotary motion into a totally sealed system without the use of stuffing boxes, freeze seals, or rotary mechanical seals is described. (auth)

17614

A REMOTELY CONTROLLED DROP-WEIGHT TEST MACHINE FOR BRITTLE FRACTURE STUDIES. L. E. Steele and J. R. Hawthorne (Naval Research Lab., Washington, D. C.). p.232-8 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Drop-weight test specimens have been irradiated in nuclear reactors and tested by remotely operated equipment to determine the effect of radiation on the ductile-to-brittle fracture transition temperature of steels. The various features of the drop-weight test machine and associated equipment for temperature conditioning the specimens, as developed for operation in a hot cell, are described. (auth)

17615

A REMOTELY OPERATED CHARPY TEST MACHINE FOR RADIOACTIVE SPECIMENS. J. R. Hawthorne and L. E. Steele (Naval Research Lab., Washington, D.C.). p.239-46 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

An apparatus has been developed to adapt a standard Charpy impact test machine for the remote testing of radioactive Charpy V-notch specimens in a hot cell. The apparatus is designed to condition specimens in the −100° to 300°F range to accurately place the specimens in testing position automatically. (auth)

17616

WET CUT-OFF SAW FOR REMOTE USE. Robert F. Stearns (Knolls Atomic Power Lab., Schenectady, N. Y.). p.247-51 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The Irradiations Laboratory was requested to design a wet cut-off saw for use on larger samples. The maximum size was specified as 14 in. × 2-¾ in. × ¼ in. A set of specifications was written to define the over-all requirements. One of the two main requirements was the ability to make accurately located cuts having a smooth surface. The other main requirement was to keep the cutting temperature below the level at which metallurgical change would take place. A study was made of all existing designs. Discussions were also held with people who have operated this type of equipment in order to familiarize ourselves with the state of the art. The finished design incorporated the main requirements plus simplicity, low cost, and light weight. Features were included that should facilitate remote decontamination. (auth)

17617

SPECTROMETER POSITIONING DEVICE. W. A. Pate (Oak Ridge National Lab., Tenn.). p.252-5 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The equipment described will position and support the spectrometer which will be used to measure the energy spectra of water-attenuated gamma rays originating from point sources. Other applications will be the measurement of the energy spectra of unattenuated gamma rays from the Bulk Shielding Facility Reactors and of the energy spectra and angular distribution of the reactor gamma rays that have penetrated shields. (auth)

17618

PHYSIOLOGY AND TOXICOLOGY OF PLUTONIUM^{239}. Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). p.256-75 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

When taken into the systemic circulation, Pu^{239} deposits predominantly in the skeleton where it may produce bone disease (including cancer) many years later. Its absorption rate from the gastrointestinal tract is only about 0.003 per cent. Absorption from the lung may be from 1 to 10 per cent of the inhaled dose, depending on particle size, solubility, etc. A small amount may be absorbed through the intact skin and through contaminated cuts and puncture wounds. Lung absorption is potentially the most important route of entry into the body and is largely responsible for the rigorous closed-systems and other industrial hygiene and engineering practices employed in plutonium processing. Once in the body, Pu^{239} is excreted extremely slowly (about 200 years being required to eliminate one-half the body burden). An individual who has reached the maximum permissible body burden, technically should be removed from further plutonium contact for the rest of his life. The maximum permissible body burden of Pu^{239} (0.04 μc) is established by comparison with Ra^{226} and is that amount which has the same improbability of producing harm to any person at any time during his natural life as does 0.1 μc of fixed Ra^{226}. Control of the industrial hazards of Pu^{239} processing is based on the premise that exposure of personnel should be as nearly zero as possible. This is not because less than the maximum permissible body burden is apt to do harm, but because it is sound industrial medical and economic practice. If presently recommended practices are maintained, there is little reason to feel that the health of a person working with Pu^{239} will be subject to any greater absolute risk than if he were engaged in any other chemical or industrial occupation. (auth)

17619

RADIOLOGICAL SAFETY PROBLEMS ASSOCIATED WITH ALPHA EMITTERS. Dean D. Meyer (Los Alamos Scientific Lab., N. Mex.). p.276-83 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The general philosophy of health surveillance as applied to research and fabrication of alpha emitters is discussed in this paper. Details are given of monitoring methods used at Los Alamos. Suggestions are given for personnel and instrumentation requirements for new installations. (auth)

17620

PLUTONIUM HANDLING HAZARDS. T. S. Chapman (Dow Chemical Co., Denver). p.284-91 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The philosophy and practices of protection from hazards accompanying plutonium processing and fabrication are described. Topics discussed are alpha and penetrating radiation and difficulties associated with the presence of fire or water. (auth)

17621

LOS ALAMOS ALPHA-GAMMA CELLS. James R. Lilienthal (Los Alamos Scientific Lab., N. Mex.). p.292-304 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The design features of sixteen alpha-gamma hot cells being planned for construction at Los Alamos are described. These cells and their supporting facilities include the best features of the experience and operational techniques developed by the Laboratory in handling alpha and beta-gamma emitters. The most distinctive feature of the cell configuration is a back-to-back layout of cells which provides a shielded corridor or radiation lock area. Further, all work involving alpha-gamma material will be done in sealed enclosures placed in the cells rather than by sealing the heavily shielded cells themselves. (auth)

17622

A PROPOSED HIGH-RADIATION-LEVEL EXAMINATION LABORATORY. S. E. Dismuke (Oak Ridge National Lab., Tenn.). p.305-12 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The Oak Ridge National Laboratory is proposing a hot laboratory for metallurgical and corrosion tests on strong alpha-gamma emitters. The facility is divided into examination cells, access cells, contaminated equipment storage cell, specimen storage cell, low radiation level area, and a more or less standard laboratory building. The examination cell areas are designed for complete remote operation including the equipment setup, specimen examination, equipment removal and decontamination operations. The access cells, equipment storage cells and the specimen storage cell are also designed for remote operation, but limited personnel access is permitted for equipment maintenance. (auth)

17623

A 90-CURIE Co^{60} IRRADIATION UNIT. A. L. Riegert and J. W. T. Spinks (Univ. of Saskatchewan, Saskatoon, Can.). p.315-24 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A simple 90-curie Co^{60} irradiation unit has been developed. The Co^{60}, contained in a lead drawer in a cylindrical lead housing, can be pushed out of the lead housing onto a track, thereby irradiating materials placed on either side of the track. Dose rates of up to 1500 r/min can be obtained. The source-house and track assembly is located in a concrete cave built with precast concrete blocks. The design provides for adequate radiation shielding and for interlocks on the source-moving mechanism and gate leading to the irradiation chamber. The unit is cheap and easy to construct and is adaptable to a wide range of radiation problems. (auth)

17624

PROGRESS IN THE TECHNOLOGY OF GAMMA IRRADIATION WITH MULTIKILOCURIE COBALT 60 SOURCES FOR THE SCIENTIFIC, INDUSTRIAL AND MEDICAL RESEARCH. Otto F. Joklik (Transcontinental Atomic Co., Vaduz, Liechtenstein). p.325-38 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A fully automatic mechanized gamma irradiation

facility with multikilocurie cobalt-60 gamma radiation sources is described. Certain constructive examples are given, in which the radiation source can either be immersed or the objects under exposure can be irradiated in any physical form, in bulk or continuously, beside the vertical rod shaped radiation source in one or more parallel irradiation cylinders. The irradiation can be switched off automatically either after a predetermined time (up to 120 hours) or after a certain dose (up to 50 millions of roentgens), and the irradiation conditions can be varied at will from +450°C to −160°C at pressures up to 1000 kg/cm^2 or in high vacuum. (auth)

17625

THE COBALT-60 IRRADIATION FACILITY AT THE DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA. R. E. Carson and B. I. Parsons (Dept. of Mines and Technical Surveys, Ottawa). p.339-48 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The 1300 curie cobalt-60 irradiation facility installed by the Department of Mines and Technical Surveys for the study of the effects of gamma radiation on fuel processes at pressures up to 20,000 pounds per square inch is described. In construction and operation of the irradiation facility the prime considerations were simplicity and economy consistent with safety. The over-all cost including engineering design, construction, and the purchase of the source is estimated at $35,000. (auth)

17626

THE DESIGN AND THE CONSTRUCTION OF A 10,000 CURIE COBALT-60 GAMMA RADIATION FACILITY. A. Danno, M. Omura, H. Hotta, H. Hirakawa, G. Tsuchihasi, and I. Yamaguchi (Japan Atomic Energy Research Inst., Tokyo). p.349-60 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A high gamma radiation facility with 10,000 curie cobalt-60 source has been in operation at the Japan Atomic Energy Research Institute for a year. The design of the irradiation cave and the construction of the source cylinder are described. The experimental results associated to this work are also given. (auth)

17627

A MULTIPURPOSE AGRICULTURAL COBALT-60 IRRADIATOR. H. J. Teas (Florida Agricultural Experiment Stations, Gainesville). p.361-70 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A multipurpose cobalt-60 agricultural irradiation facility of about 6000 curies is described. The irradiator is stored in a tank of water and raised into a radiation pit for use. The irradiator contains 12 loaded tubes which are arranged as a hollow cylinder source. The volume within the irradiator permits treatment of approximately ¼ bushel of food or animal feed at relatively high intensity, and at the same time the irradiator serves as a point source for lower radiation doses for such uses as mutation production. (auth)

17628

A GAMMA IRRADIATION FACILITY EMPLOYING EIGHT SPENT MTR FUEL ELEMENTS. P. J. Manno (Continental Oil Co., Ponca City, Okla.). p.371-86 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Continental Oil Company at Ponca City, Oklahoma, has placed into operation a very versatile gamma irradiation facility employing eight spent MTR fuel elements. The facility consists of a hot cell, a canal and storage pool, beam irradiation room, an operating and experiment-preparation area, supported by conventional laboratories, etc. A complete description of the radiation laboratory is presented, emphasizing the flexibility of the facility. Measurements of the shielding effectiveness are also discussed. (auth)

17629

TECHNIQUES, EQUIPMENT AND METHODS OF OPERATION USED AT THE KAPL RADIOACTIVE MATERIALS LABORATORY REMOTE METALLOGRAPHY CELL. B. D. Wemple (Knolls Atomic Power Lab., Schenectady, N. Y.). p.387-96 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The various methods, techniques, and equipment used for the mounting, grinding, polishing, etching, and replication of metallographic samples in a remote metallography cell are described. (auth)

17630

LIQUID WASTE DISPOSAL METHODS AT BETTIS HOT LABORATORY. W. L. Bryant and L. M. Behr (Westinghouse Electric Corp., Pittsburgh). p.397-401 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The processing of radioactive liquid wastes involves removing the contaminants from water used during sectioning, polishing, and etching operations. The average radioactivity level of this waste is 100 mr/hr/gal and may reach peak levels of 800 mr/hr/gal. Sufficient contaminants must be removed from the water to reduce the radioactivity to 20 mr/hr/5 gal before it can be released to the main plant processing system. The contaminants, which consist of particulate matter and soluble ions, must then be prepared for sea burial. From contaminated sources such as high level cells, metallography cells, dry waste storage pit, and the decontamination room, the liquid wastes are routed through floor drains to the underground storage tanks. The drains are fitted with polyethylene liners to allow replacement without excavation. Wastes are drawn from the tanks as the capacity of the processing system allows. Present methods of processing hot liquid wastes are expensive in time, personnel radiation exposure and material cost. Although most of the expense is inherent in this type of operation, the Bettis Hot Laboratory has analyzed its existing liquid waste disposal equipment and procedures for possible cost reductions. The conclusions of this analysis, in addition to comments drawn from operating experience, are discussed after a brief description of each section of the waste processing system. Also included are descriptions of equipment which will replace or supplement existing equipment in conjunction with the expansion of facilities now in process and scheduled for completion in early summer, 1959. (auth)

17631

FUEL ROD FABRICATION DEVICE. T. A. Golding, D. Janeves, M. A. Fallandy, F. E. Vonderahe, and K. L. Mattern (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). p.402-8 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A remotely operated and remotely maintained fuel rod fabrication device is described. The device is for fabrication of highly radioactive re-processed fuel slugs into fuel rods for re-irradiation in the SRE

(Sodium Reactor Experiment). Because of the high level of radioactivity in the fuel and the nature of the operational cycle of loading, fabrication and unloading of the device must be controlled remotely. Maintenance of the equipment also must be accomplished remotely. An out-of-cell console is used to control pneumatic and electrical actuators on the device. The mechanisms are remotely replaceable unit sub-assemblies, which facilitates maintenance. A prototype device for fabrication of short, dummy fuel rods has been built and remotely operated. (auth)

17632

THE DISASSEMBLY AND SAMPLING OF AN IRRADIATED EBWR FUEL SUBASSEMBLY. C. F. Reinke and L. S. Markheim (Argonne National Lab., Lemont, Ill.). p.409-18 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The Experimental Boiling Water Reactor has been operating successfully since December 1956, during which power levels up to three times the design value were attained. A subassembly having an estimated average burnup of 0.25 percent of the total core atoms was discharged from the reactor on January 2, 1958. Information on the effects of radiation and operating conditions was desired. This paper discusses the equipment and procedures developed to cope with the disassembly and sampling of the EBWR fuel subassembly. (auth)

17633

A DYNAMIC CORROSION FACILITY FOR IRRADIATED FUEL. K. R. Hunter (Knolls Atomic Power Lab., Schenectady, N. Y.). p.419-23 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

A high-temperature, high-pressure loop has been placed in operation at the Radioactive Materials Laboratory of the Knolls Atomic Power Laboratory to provide a dynamic model for corrosion studies of irradiated fuel. With this facility, it is possible to maintain continuous control of such water conditions as temperature, pressure, pH, oxygen content, hydrogen content and flow rate. Thus, it is possible to simulate reactor conditions with the exception of a neutron flux. Corrosion data are obtained by measuring the activity buildup in the loop water by gamma spectrometer counting of a portion of the loop piping, by radiochemical analyses of water samples, and by metallographic examination of the corrosion specimens. In addition to corrosion data, such related problems as fission product and corrosion product transport and deposition, and accessibility are being studied. The loop, shown in a schematic diagram, consists of a steam pressurizer with a three kilowatt immersion heater, a one-half inch stainless steel pipe main loop with two immersion heaters of fourteen kilowatt output, an oil cooled canned rotor pump, a sample section, and a deposition section. Immediately after the deposition section is a by-pass section consisting of a hot crud filter, and two loop water sample bombs. The hot crud filter is an autoclave type container housing a porous nickel filter which is precoated with spectrographic graphite at the start of each run. (auth)

17634

RADIOACTIVE MATERIAL HANDLING. A. L. Maharam and R. R. Fouse (Westinghouse Electric Corp., Pittsburgh). p.424-32 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Radioactive material handling is discussed both from the problem of correct design and actual operations. Material handling equipment is described from the point of view of activity levels, size of the samples, ease and dependability of operation, and problems encountered in contamination control. (auth)

17635

HYDROSTATIC BURST TEST ON IRRADIATED PWR FUEL ELEMENTS. J. H. Bowling (Westinghouse Electric Corp., Pittsburgh). p.433-8 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

An experiment is described, the purpose of which was to burst irradiated PWR fuel elements remotely in a kilocurie hot cell equipped with a General Mills manipulator and two Model 8 master slave manipulators to determine the effect of irradiation on the bursting strength of the fuel element cladding. The PWR fuel elements were irradiated in a pressurized water test loop simulating operating conditions in the PWR reactor. Equipment and results are described. (C.H.)

17636

ANALYTICAL SERVICE FOR THE HOMOGENEOUS REACTOR TEST. U. Koskela, L. G. Farrar, J. E. Attrill, and J. L. Mottern (Oak Ridge National Lab., Tenn.). p.439-44 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The analytical operational experiences of the High-Radiation-Level Analytical Facility of the ORNL Analytical Chemistry Division during recent power operations of the Oak Ridge Homogeneous Reactor are presented. (auth)

17637

DESIGNING EQUIPMENT FOR UNDERWATER FACILITIES. J. K. Figenshau and G. C. Kelly (General Mills, Inc., Minneapolis). p.445-56 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

Criteria affecting the design of equipment for use in underwater facilities are discussed. Topics discussed include the advantages and disadvantages of underwater operation, methods of operation, power driven equipment and power requirements, component availability, selection and suitability, material selection and compatability, viewing considerations, lubrication of equipment, and protection of equipment against ambient conditions. (auth)

17638

IN-REACTOR TESTING OF FUEL ELEMENTS. D. C. Kaulitz (General Electric Co., Richland, Wash.). p.457-60 in "Proceedings of the Seventh Hot Laboratories and Equipment Conference."

The design and operation of some of Hanford's in-pile testing facilities at ETR, Idaho Falls, Idaho, are described. The in-reactor apparatus provides both high radiation flux and high temperature water so that operational difficulties at high power levels can be investigated. Quick charge and discharge mechanisms are described for facilitating these periodic checks. (auth)

17639

MECHANICAL CONNECTION FOR GENERALLY CYLINDRICAL VESSEL CLOSURES. (to Atomic Energy of Canada, Ltd.). British Patent 814,423. June 3, 1959.

A means for closing but not sealing the ends of cylindrical or generally cylindrical pressure vessels is described. The closure piece fits inside the end of the

vessel, and it has grooves or keyways in its edge which correspond to keyways in the inside of the end of the vessel. Thus, when the closure piece is inserted in the vessel, the keyways form helical slots into which keys of flexible steel are inserted to secure, through friction, the closure to the vessel. Fluid-tight sealing can be effected by conventional means. (T.R.H.)

17640

IMPROVEMENTS IN OR RELATING TO SEALING DEVICES. (to Escher Wyss Aktiengesellschaft). British Patent 815,884. July 1, 1959.

A sealing arrangement is described for use with turbomachinery in gas-cooled reactor coolant channels. This arrangement prevents radioactivity in the coolant gas from escaping around compressors and other rotary devices to the atmosphere by passing the gas through an absorber. This absorber consists of materials such as charcoal or silica suspended in solvents such as alcohol or water. (T.R.H.)

BIOLOGY AND MEDICINE

17641 AECU-921

Beryllium Advisory Committee, AEC.

CURRENT KNOWLEDGE OF DISEASE ENCOUNTERED IN THE HANDLING OF BERYLLIUM AND ITS COMPOUNDS: CLINICAL, PATHOLOGICAL, EXPERIMENTAL, AND ENGINEERING DATA. Symposium Held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, January 18, 1950. 69p. $10.80(ph), $3.90(mf) OTS.

This symposium deals with the clinical reports on beryllium illness in various industries, engineering control of beryllium hazards, basis for environmental control of beryllium poisoning, pathology of acute diseases, chronic occupational and non-occupational pulmonary berylliosis, pathology of beryllium-induced skin lesions, and biochemical effects of beryllium. A report on animal studies is given. (J.E.D.)

17642 AECU-4011

Los Alamos Scientific Lab., N. Mex.

EFFECTS OF RADIATION ON TUBERCULOSIS. Ruth M. Hendrickson. Apr. 30, 1958. 67p. Contract [W-7405-eng-36]. (D-BIB-24). $4.80(ph), $2.70(mf) OTS.

A bibliography is presented which covers the literature from 1900 to 1958 on applications of radiation in diagnosis and therapy of tuberculosis. (C.H.)

17643 AERE-Med/R-2854

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE NATURAL HISTORY OF BERYLLIUM DISEASE. Katharine Williams. May 1959. 39p. $0.77(BIS).

A historical survey of the recognition of beryllium and its compounds as the causative agent in beryllium disease is given. The correlation of disease incidence with atmospheric pollution and the derivation of tentative maximum allowable concentrations of beryllium in the air of workshops is discussed. Medical aspects of the disease in the acute and chronic state are enumerated. (auth)

17644 AF-SAM-58-143

Texas. Univ., Austin.

RUNNING WHEEL ACTIVITY OF RATS TESTED UNDER VARYING CONDITIONS OF FOOD DEPRIVATION THIRTY-THREE DAYS AFTER ACUTE EXPOSURE TO 1,050 R OF GAMMA RADIATION. A. A. McDowell and W. Lynn Brown. June 20, 1958. 4p.

Four normal and five acutely irradiated male Sprague-Dawley rats, all of the same age, were compared with respect to running wheel activity under four food deprivation. Irradiates were compared with controls 33 days following acute exposure to 1,050 r of Co^{60} gamma radiation. The mean running wheel activity for the animals of the normal group over the four deprivation schedules was significantly greater than that for the animals of the irradiated group. Running wheel activity varied significantly with deprivation schedules. The interaction between groups and deprivation schedules was significant. A significantly greater gain in running wheel activity during the second than during the first 4-day period of total food deprivation was noted. (auth)

17645 HW-60127

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ON THE PASSAGE OF PAIRS OF ELEMENTS THROUGH FOOD CHAINS. H. A. Kornberg. May 1, 1959. 37p. Contract W-31-109-Eng-52. $1.00(OTS).

The relationship of element pairs passing through food chains is discussed. Emphasis is placed on the calcium–strontium-90 and potassium–cesium-137 pairs. Mechanisms are described by which strontium and calcium are passed along food chains. Experimental facts and theory are combined to question the use of element-pair ratios in evaluating hazards of the radioactive member of the pair. (C.H.)

17646 M-7120

[Division of Biology and Medicine], AEC.

METABOLISM OF STRONTIUM, CESIUM AND YTTRIUM BY ANIMALS. Paul B. Pearson. June 24, 1955. 17p. $3.30(ph), $2.40(mf) OTS.

Data are summarized from a series of studies on the metabolism of fission products by domestic animals. Tabulated results are included on the effect of age on the absorption and renal excretion of strontium-90 by cattle, the rate of excretion of orally ingested strontium-90 by cattle, the secretion of strontium-90 into milk, the deposition of strontium-90 in eggs, and the excretion pattern of cesium-137 in rats and cattle. The deposition and excretion of yttrium in rats are discussed briefly. (C.H.)

17647 M-7122

[Division of Biology and Medicine, AEC.]

UPTAKE OF FISSION MATERIALS BY MAMMALIA. Paul B. Pearson. [nd]. 11p. $3.30(ph), $2.40(mf) OTS.

Biochemical factors affecting potential health hazards from the ingestion of fission products by plants and animals are discussed. It is pointed out that significant amounts of external activity can be removed from foodstuffs by washing with water, and activity induced in food stuffs by an atomic detonation is not believed to constitute a serious hazard. Data are included on the distribution in nature and metabolism of strontium, yttrium, iodine, ruthenium, and cesium. Mechanisms by which radioisotopes of these elements may be incorporated into the food chain are discussed. (C.H.)

17648 M-7126

Bureau of Plant Industry, Soils, and Agricultural Engineering. Div. of Soil and Plant Relationships, Beltsville, Md.

RUTHENIUM(III) AND IRON UPTAKE BY RED CLOVER

FROM NUTRIENT SOLUTION. R. G. Menzel and I. C. Brown. [195?]. 4p. $1.80(ph), $1.80(mf) OTS.

Data are presented on the distribution of ruthenium-103-106 and iron in various parts of red clover plants grown in nutrient solutions with various ratios of ruthenium to iron. (C.H.)

17649 NP-7709

Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø.

LEVNEDSMIDDELKONSERVERING VED BESTRÅLING. ORIENTERENDE MØDE PÅ RISØ DEN 25. FEBRUARY 1959. (Food Preservation by Radiation. Orientation Meeting at Risø, February 25, 1959.) Apr. 1959. 91p.

A résumé of the reports and discussions at the orientation meeting on Danish research on food preservation by irradiation is presented. The topics discussed included a description of irradiation facilities at Risø, measuring devices and methods for ionizing radiation, effects of ionizing radiation and individual effects on various materials, radiation preservation of meat, radiation preservation and sterilization, radiation preservation of fruits and vegetables, budding inhibition in potatoes by irradiation, insect control on corn and corn products by radiation, radiation conservation of milk products and eggs, taste, bacteriological, and chemical investigations of irradiated milk products, radiation preservation of fish, and health problems with respect to irradiated food. (J.S.R.)

17650 NP-7730

Department of Agriculture. Western Utilization Research and Development Div., Albany, Calif.

RADIATION PRESERVATION OF POULTRY PRODUCTS. Report No. 4 (Final) [for] June 1, 1957 to June 30, 1958. Hans Lineweaver. 13p. Project No. 7-84-01-002.

Results are reported from preliminary consumer-type acceptance tests on irradiated chicken meat. Data are included on the effect on flavor of cooked chicken of a combined irradiation-heat treatment process. (C.H.)

17651 NP-7732

Quartermaster Food and Container Inst. for the Armed Forces, Chicago.

EFFECT OF IONIZING RADIATION ON PHYSICAL AND CHEMICAL STRUCTURE OF PROTEINS. Progress Report No. 15 (Final) for June 1, 1954–February 1, 1959. Maurice P. Drake. 11p. Project No. 7-84-01-002.

Early work in this problem is reviewed. The review included studies on amino acid irradiation lability (in insulin and as nitrogen-acetylated amino acids), flavor fractionation of irradiated beef, thiobarbituric acid assay of irradiated milk, stability of the amide bond to irradiation, and the use of a steam-distillation measurement of volatile reducing substances for evaluating irradiated meat. More recent studies are reported on the use of adsorbent materials for reducing the irradiation odor and flavor in meat products, and the completed study on time and temperatures required to heat-inactivate proteolytic enzymes in irradiated beef and pork products. (auth)

17652 NP-7733

National Dairy Products Corp. Kraft Foods Div., Glenview, Ill.

EFFECTS OF IRRADIATION ON FRESH FRUITS AND VEGETABLES. Report No. 8 (Final) [for] August 6, 1956–August 5, 1958. W. L. Hock. 9p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 57 (Agreement).

Pineapple chunks and fruit salad consisting mainly of citrus fruit have been irradiated by means of gamma rays in an attempt to increase the shelf-life of the fresh refrigerated fruit. Appreciable extension of shelf life occurred when irradiation level was of the order of 500,000 rads or more. Irradiation off-flavors were noticeable in samples receiving dosages as low as 100,000 rads. Attempts to eliminate or reduce irradiation off-flavors by including additives were not successful. Nor did irradiation while frozen eliminate off-flavor formation. (auth)

17653 NP-7734

American Cyanamid Co. [Stanford Labs.], Stanford, Conn.

USE OF ANTIBIOTICS AND/OR CHEMICAL ADDITIVES IN COMBINATION WITH RADIATION TO PRESERVE FRESH MEAT ITEMS. Report No. 1 (Final) [for] December 1, 1957 to December 1, 1958. Walter L. Clark. 9p. Project No. 7-84-01-002, Contract QMRE&E (Natick) No. 76 (Agreement).

Exposure to doses of 0.1 megarad irradiation combined with treatment with chlortetracycline solutions was effective in preventing the development of bacteria on the surface of beef stored at 4°C for 21 days. (C.H.)

17654 NP-7786

Chicago. Univ. Air Force Radiation Lab.

QUARTERLY PROGRESS REPORT NO. 32. July 15, 1959. 155p. Contract AF41(657)-252.

Data are reported from the following studies: the effects of whole-body x irradiation on glutathione levels in tissues of rats and mice; the ability of the radioprotective agents 2-amino-ethylisothiuronium dichloride, 2-mercaptoethylamine, and dimethylammonium dimethyldithiocarbamate to alter the reduced glutathione levels of rat tissues; measurements of the radioprotective effect of various chemical agents; the survival time and mortality of mice treated with 82 various chemical compounds immediately prior to the administration of a lethal dose of whole-body x radiation; the effects of 51 various radioprotective agents on the oxygen consumption, carbon dioxide production, and methemoglobin levels in normal mice; studies on the kinetic and synthetic aspect of the acid-catalyzed reactions of cyclic amines with thiourea and its analogs; the mortality of mice following exposure for extended periods early in life to low-level doses of gamma and fast neutron irradiation; and studies on the effect of chronic irradiation with gamma rays and fast neutrons on the reaction time of mice to electrical and auditory stimuli. (For preceding period see NP-7527.) (C.H.)

17655 NP-7801

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ON THE MECHANISM OF DIGESTION OF I^{131} LABELLED FIBRINOGEN. Report No. 90/X. E. Kowalski and A. Z. Budzyński. May 1959. 17p.

Results are reported from an electrophoretic study of the mechanism of plasmin-induced proteolysis of fibrinogen, using iodine-131 labeled fibrinogen as a substrate. (C.H.)

17656 NYO-4464

Atomic Bomb Casualty Commission, Hiroshima.

EFFECTS OF RADIATION ON HUMAN DENTITION—PRELIMINARY REPORT. PROGRESS REPORT OF PROJECT OA-44. T. Terasaki and K. Shiota. June 30, 1953. Changed from OFFICIAL USE ONLY Oct. 11,

1956. 15p. Contract AT-49-1-GEN-72. $3.30(ph), $2.40(mf) OTS.

Preliminary data are presented from a dental survey conducted on children of Hiroshima to determine the effects of radiation from the atomic bomb on the tooth-germs which were forming within the jaw at the time of the bombing. (C.H.)

17657 RISLEY-5006/25

Gt. Brit. Springfields Works, Springfields, Lancs, England.

INDUSTRIAL TOXICOLOGICAL SUMMARY NO. 3 TRICHLORETHYLENE. E. F. Edson. Jan. 5, 1950. 11p.

Trichlorethylene ($CHCl:CCl_2$) is a stable low-boiling-point, virtually non-inflammable solvent with valuable extraction properties and wide industrial uses. The toxicity of trichlorethylene is largely restricted to an acute narcotic effect after the inhalation of moderate to high concentrations of the vapor, and a capacity to cause skin injuries. There is probably no chronic toxic effect, but habituation and addiction occasionally occur. The acute inhalational risk makes specific precautions necessary. In the period 1937-1947, the Factory Inspectorate reported 214 cases of trichlorethylene gassing, of which 11 cases proved fatal. Protective measures to be considered in plant design and operation for the control of inhalational and contact risks are listed. The maximal allowable average concentration of trichlorethylene in the atmosphere of working areas is recommended as 200 parts per million (1 mg/l). Information is given on physical properties, toxicological data, and the diagnosis and treatment of poisoning by trichlorethylene, with further references. (auth)

17658 UR-547

Rochester, N. Y. Univ. Atomic Energy Project.

THE BINDING OF MERCURY BY THE YEAST CELL IN RELATION TO CHANGES IN PERMEABILITY. Hermann Passow and Aser Rothstein. May 7, 1959. 23p. Contract W-7401-eng-49. $4.80(ph), $2.70(mf) OTS.

Mercury in the form of mercuric chloride causes a breakdown in the cellular membrane of yeast cells with a release of cellular potassium and other constituents. Copper has a similar but lesser effect, whereas lead and zinc, even at ten times the concentration, have no such effect. The response is all or none for individual cells, so that the measured response is a measure of the dispersion of thresholds of resistance in the population. Parallel studies of mercury binding and desorption indicate no simple stoichiometric relationship with physiological response. (auth)

17659 UR-552

Rochester, N. Y. Univ. Atomic Energy Project.

DEPOSITION, RETENTION AND FATE OF INHALED POLONIUM-210 IN RATS. Louis J. Casarett. June 17, 1959. 61p. Contract W-7401-eng-49. $10.80(ph), $3.90(mf) OTS.

Forty-four lightly narcotized rats were given an inhalation exposure of Po^{210} on a NaCl carrier with a count median diameter of 0.046 μ. Rats were sacrificed immediately and at intervals up to 30 days post-exposure. Complete urine and feces collections were made and analyzed and all tissues were analyzed for polonium content. It was estimated that a mean of 33 percent of the inspired material was deposited, divided approximately in two equal fractions for upper and lower respiratory tracts. The material deposited in the upper part of the tract was cleared with a half-time of about 8 to 12 hours. The lung retention has been expressed in several ways, the most precise statement of retention yielding a half-time of 17.5 days. The total body load, beyond 2 to 3 days, falls to half its initial value in about 30 days. By 30 days post-exposure, the blood contains about 2% of the initial dose. The concentration of polonium distributed from the lung is highest in kidney, next in spleen. Significant concentrations were found in pulmonary lymph nodes and liver. After 3 to 4 days, during part of which time the material deposited in the upper respiratory tract appears in the feces, the fecal to urine ratio averaged about 12 for the period studied. The significance of these and other findings is discussed. (auth)

17660 USNRDL-TR-324

Naval Radiological Defense Lab., San Francisco.

STUDIES ON THE MECHANISM OF SECONDARY DISEASE: THE PARENTAL-F_1 HYBRID RADIATION CHIMERA. L. J. Cole and R. M. Garver. May 13, 1959. 22p.

The wasting syndrome was elicited in 500 r x-irradiated LAf_1 hybrid mice, not only when A-strain spleen cells were injected immediately after irradiation, but also after an interval of 8, 15, or 22 days post-irradiation. Apparently, functional lymphoid recovery had not as yet occurred at this time, in spite of the spleen weight recovery after 15 days. At 47 days post 500 r, the F_1 hybrids were able to survive after injection of spleen cells. In non-irradiated LAf_1 mice, injection of A-strain spleen cells into young adult recipients did not elicit deaths; by contrast, injection of A spleen cells in non-irradiated old LAf_1 mice caused deaths. On the basis of these findings, a mechanism of production of the lethal syndrome is proposed, and some consequences with respect to the general problem of secondary disease are discussed. It is suggested that secondary disease involves a continuous dynamic, mutual cell-to-cell homograft reaction between donor and host lymphoid cells, which results in killing off of both types of lymphoid cells, and an animal with atrophic lymphoid tissues. The hypothesis also accounts for the differential in lymphoid regeneration in lethally x-irradiated recipients following isologous versus non-isologous marrow therapy. (auth)

17661 USNRDL-TR-339

Naval Radiological Defense Lab., San Francisco.

SOME ASPECTS OF RECENT FINDINGS PERTAINING TO THE BODY COMPOSITION OF ATHLETES, OBESE INDIVIDUALS AND PATIENTS. A. R. Behnke and W. L. Taylor. June 30, 1959. 19p.

Whole-body density determinations are reported for a small group of athletes (weight lifters), and an analysis is presented of data derived from several investigations in which similar techniques were employed to measure total body water and the total exchangeable sodium, chloride (bromine space), and potassium in the body. The mean value for body density (1.080) obtained on the athletes was similar to that obtained previously on professional football players and much higher than the mean value usually obtained on young men (~ 1.060). In addition to the low body fat content characteristic of the athletes, the ratio of exchangeable K_e to Cl_e was higher in these men than in men of average physique. In turn, the values for K_e/Cl_e were even lower in obese individuals and in patients. In healthy individuals, the sum $(K_e + Cl_e)$ is highly correlated ($r = 0.99$) with total body water, and this finding provides an independent estimate of lean body weight. In patients afflicted with certain types of chronic diseases, particularly those associated

with the edematous state, the exchangeable Na_e to K_e ratio is strikingly higher than it is in healthy individuals. Estimates of the amount of transudate in edematous patients may be made from analyses of total body water and total exchangeable Na_e and K_e. Additional determinations, such as whole body density and red cell mass, are required to assess accurately the size of the lean body mass in these patients. Normal adult lean body size prior to illness may be estimated from skeletal measurements. (auth)

17662 USNRDL-TR-340
Naval Radiological Defense Lab., San Francisco.
COMMENTS ON THE DETERMINATION OF WHOLE BODY DENSITY AND A RÉSUMÉ OF BODY COMPOSITION DATA. A. R. Behnke. July 16, 1959. 21p.

Various methods are described which have been used for measurements of body composition and density. Anatomical data and methods of chemical analysis are reviewed. Correlations are made between specific gravity or density and body fat and water. Differences in body fat content in men and women and possible changes in mean body density with age are discussed. Applications of radioisotopes of hydrogen, potassium, bromide, and sodium and x-ray techniques for the measurement of bone diameters and areas as well as fat thickness are discussed. It is pointed out that the determination of body volume by hydrostatic or dilution techniques is a highly refined quantitative procedure which requires consummate care to achieve the desired accuracy. (C.H.)

17663 JPRS-L-515-N
CHEMICAL PROTECTION OF ANIMALS AGAINST THE ACTION OF X-RAYS. V. G. Yakovlev and I. I. Ivanov. Translated from Med. Radiol. 3, No. 5, 14-19(1958). 10p. $0.50(OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2669.

17664 JPRS-L-519-N
THE SECOND SCIENTIFIC CONFERENCE TO THE EFFECT OF IONIZING RADIATION ON THE HIGHER DIVISIONS OF THE CENTRAL NERVOUS SYSTEM. M. G. Ayrapetyants. Translated from Med. Radiol. 3, No. 5, 95-6(1958). 6p. $0.50(OTS).

Brief summaries are presented of papers covering a number of studies on radiation effects on the central nervous system. Emphasis was placed on the influence of antenatal radiation on functions of the higher nervous system, and also the influence of comparatively small doses of radiation on higher nervous activity. (C.H.)

17665 JPRS-L-1437-D
THE INFLUENCE OF NUTRITION OF THE COURSE OF RADIATION INJURIES IN ANIMALS. M. F. Nesterin and G. P. Yeremin. Translated from Voprosy Pitaniya 17, No. 5, 3-8(1958). 12p. $0.50(OTS).

A review is presented of the literature on the influence of nutrition on the course of radiation injuries in animals. It is concluded that the state of nutrition exerts a substantial effect upon the course and outcome of radiation sickness. (C.H.)

17666 NP-tr-255
ON CERTAIN PHYSIOLOGICAL AND MORPHOLOGICAL CHANGES IN THE EYES OF POTATO TUBERS SUBJECTED TO IRRADIATION. E. G. Sal'kova and N. P. Korableva. Translated by V. Beak (U.K.A.E.A., Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 121, 1097-1100(1958). 9p. $1.80(ph), $1.80(mf) JCL or LC. (Figures omitted).

Observations are described on physiological and morphological changes in the eyes of potato tubers induced by gamma irradiation. (C.H.)

17667 NP-tr-258
THE PROBLEM OF DUST RETENTION IN THE LUNGS. Helmut Lüchtrath. Translated by E. L. Poole (U.K.A.E.A., Atomic Energy Research Establishment) from Arch. pathol. Anat. u. Physiol. Virchow's 329, 177-83(1956). 8p. $1.80(ph), $1.80(mf) JCL. (Figures omitted).

Observations are reported which were made on the lungs of rats one month following intratracheal injection of an aluminum silicate powder. A consolidation of the inert dust in the alveolar cavities was observed histologically. (C.H.)

17668 NP-tr-268
THE ACTION OF URANIUM ON THE PLANT CELL. (L'azione dell'Uranio Sulla Cellula Vegetale.) C. Acqua. Translated by Cecil Pinkerton (National Institutes of Health) from Arch. farmacol. sper. 14, 81-4(1912). 7p.

Dilute solutions of uranium salts and thorium caused a retardation of the development of root systems in plants. A study was made of the localization of the ions of uranium and thorium in plants, and results compared to studies on the localization of manganese salts. Observations on plant physiology and nutrition are described. (C.H.)

17669
TISSUE DOSAGE MEASUREMENTS FOR HARD X-RAYS. B. M. Isaev and M. I. Shal'nov. Atomnaya Energ. 6, 57-62(1959) Jan. (In Russian)

The depth dose distribution in a paraffin phantom at maximum energies of 80, 180, and 250 Mev was studied. The maximum ionization position is well approximated by the analytical expression $(d/\sqrt{E}) = 1.14(1-e^{-0.1E})$ for $E > 4$ Mev, where E is the maximum energy of bremsstrahlung (Mev) and d is the maximum depth (g/cm^2). Measurements of hard bremsstrahlung mean tissue doses by means of thimble ionization chambers and calorimeters are discussed. (tr-auth)

17670
CYTOGENETIC EFFECTS OF SMALL RADIATION DOSES ON MAMMALS. V. Parkhitko (Inst. of Cytology and Genetics, Siberian Section of the Academy of Sciences, U.S.S.R.). Atomnaya Energ. 6, 690-2(1959) June. (In Russian)

The results of studies of the cytogenetic effects of small x-ray doses (4 r) on the gonad cells of rabbits, guinea pigs, white rats, and white mice are discussed. (R.V.J.)

17671
THE EFFECT OF IONIZING RADIATION ON PLANT GROWTH AND YIELD. Adalbert Süss (Bayer. Landesanstalt für Pflanzenbau und Pflanzenschutz, Munich). Atompraxis 5, 219-23(1959) June. (In German)

The influence of ionizing radiation on growth in summer barley and summer wheat was examined in laboratory and pot experiments. Irradiation was carried out in the research reactor in Munich. One sample was hung directly over the reactor core in the swimming pool; the other was hung four meters higher. Exposure lasted one hour. The gamma dose 0 meter above the core was 10^4 r, the neutron flux was 2×10^{15} n/cm^2. Four m above the core the gamma dose was only 400 mr. The laboratory and pot experiments showed greater

radiation sensitivity in summer barley than in summer wheat. Bud tests showed that double irradiation (0 meters above the core) produced marked bud damage and retardation in both wheat and barley; the greater effect was found in barley. Fourteen-day sprout-length measurements in young plants showed a stimulative effect on both growth length and dry-weight yield in the plants exposed to simple irradiation. The weight dry-weight yield was 6.1% and that of barley 5.4% higher than in the non-irradiated samples. Pot experiments in which growth was observed during the entire vegetation time are also described. During the time of observation no difference was found between the untreated series and those exposed to simple irradiation in regard to growth, bushing, and earing. The barley sample exposed to double irradiation suffered total damage and died after three weeks. The similarly treated wheat sample (0 meter above the core) at first showed slight radiation damage (marbling), but this disappeared during the further course of growth. During the entire vegetation time these plants had a malnourished appearance. The wheat plants remained stunted during the whole period, grew at various rates, and showed greater bushing, spiral-shaped rolls on the upper blades, and 37% abnormal ear forms. The stimulative effect in the wheat samples exposed to simple irradiation continued up to harvest. The straw yield was increased by 4.4%, the grain yield by 5.5%. The barley sample in the same series showed no definite change in yield. (auth)

17672

STUDIES OF THE MECHANISM OF THE PROTECTIVE ACTION OF SULPHYDRYL COMPOUNDS AND AMINES AGAINST NITROGEN MUSTARD (HN2) AND ROENTGEN IRRADIATION IN MICE. A. J. Therkelsen (Univ. of Aarhus, Denmark). Biochem. Pharmacol. 1, 258-66 (1959). Mar.

It is shown that glutathione (GSH) lowers the lethal effect of cysteamine in mice, just as previous investigations suggested that GSH lowers the cytotoxic effect of cysteamine in tissue-culture experiments. It is also shown that GSH does not change the radioprotective action of cysteamine, and that it increases the ability of cysteamine to protect mice against nitrogen mustard (HN2). Accordingly, the present investigation weighs against the assumption that the mechanism of the toxic effect of cysteamine is identical to that of the protective action of the compound against x rays and HN2, as claimed by Eldjarn and Pihl. Comparative studies on the protection against x rays and HN2 afforded by cysteamine, some cysteamine derivatives, tryptamine, tyramine, and aminoethyliso-thiouronium-hydrobromide (AET) are reported, and the results are discussed. It is emphasized that after a $LD_{98.5}$ of HN2 death of the animals seems to be due to intestinal destruction, while the cause of death after a LD_{97} of x irradiation is apparently destruction of the bone marrow. (auth)

17673

PHOTOSYNTHESIS STUDIES WITH TRITIATED WATER. V. Moses and M. Calvin (Univ. of California, Berkeley). Biochim. et Biophys. Acta 33, 297-312(1959).

A study has been made of the incorporation patterns of tritium from tritium oxide by Chlorella cells under conditions of light and dark. A new apparatus has been designed for use in photosynthesis experiments which necessitate the employment of dense cell suspensions and substrates of high specific activity. The incorporation patterns of $C^{14}O_2$ in the presence and absence of tritiated water showed little evidence of physiological damage due to radiation. The substances incorporating tritium were essentially the same as those incorporating C^{14} from $C^{14}O_2$. However, the percentage distribution of the tracer among the labelled compounds showed considerable differences from the carbon pattern. At the shortest incubation periods in the light, tritium appeared mainly in the sugar monophosphates, phosphoglyceric acid, aspartic acid, glutamic acid, and malic acid. These substances also incorporated label most rapidly in the dark, though in this case a greater percentage of the activity fixed appeared in the amino acids. About three times as much tracer was fixed in the light as in the dark. The total activity fixed, and its distribution, was affected to some extent by the presence of ammonium or nitrate ions in the medium. Glycollic acid was labelled very early, and was the most active compound present. A scheme for hydrogen transport in photosynthesis involving an alternate oxidation and reduction of glycollic and glyoxylic acids is proposed. The difficulties of interpreting the results of biochemical studies with hydrogen isotopes due to non-specific exchange reactions are discussed. (auth)

17674

DETECTION OF A STATE OF AUTOSENSITIZATION OF AN IRRADIATED ANIMAL BY MEANS OF LOCAL SKIN TESTS. N. N. Klemparskaia, N. A. Kraevskii, and V. V. Shikhodyrov. Bull. Exptl. Biol. Med.(USSR) (English Translation) 46, 1443-7(1958) Dec.

The possibility of detecting the state of sensitization of the irradiated body to the products of disintegration of its own tissues and of those obtained from animals belonging to the same species (labial administration by Freund-Stone's method) was studied. It was established that in definite doses of irradiation a hyperergic reaction with edema, necrosis, and hemorrhages occurs at the site of administration at a definite period of the radiation sickness. Such a reaction is caused only by the extracts of homologous tissues and not by the introduction of bacteria or foreign proteins. The reaction is negative in the nonirradiated animals and during the first 48 hours after the irradiation. (auth)

17675

THE ACTION OF A CHEMICAL IRRITANT (OZOKERITE) ON THE EPIDERMIS AFTER LOCAL X-RAY IRRADIATION. I. F. Prizhivoit. Bull. Exptl. Biol. Med.(USSR) (English Translation) 46, 1490-3(1958) Dec.

X irradiation of a rabbit's ear with doses of 500 and 1000 r results in thickening of the epidermis and in increase of the number of cellular layers. In additional irritation with ozokerite the irradiated epidermis gives a weaker reaction than the one which was not subjected to irradiation. X irradiation produces a double effect. At first it intensifies the physiological regeneration of the epidermis, and later it decreases the reactivity of this layer of the skin. (auth)

17676

THE EFFECTS OF HEATING OR GAMMA IRRADIATION ON THE GERMINATION OF SPORES OF BACILLUS SUBTILIS. Jean Hermier (Station Centrale de Recherches laitieres et de Technologie des Produits animaux, C.N.R.Z., Jouy-en-Josas, France). Compt. rend. 249, 195-7(1959) July 6. (In French)

Heat treatment or α irradiation of SJ2 B. subtilis spores activates germination but inhibits post-germinative growth. (tr-auth)

17677

RESISTANCE OF THE RAT IN AUTO-ANOXIA TO THE

ADMINISTRATION OF A LETHAL DOSE OF X RAYS. Jean Loiseleur and Michelle Petit. Compt. rend. 249, 323-5(1959) July 15. (In French)

The adult rat survives a lethal dose of x rays if placed in a box, before irradiation, where the oxygen tension of the air he breathes can be lowered. (tr-auth)

17678

CUTANEOUS REGENERATION IN THE IRRADIATED WHITE RAT (X RADIATION). G. C. Velley (Faculté des Sciences, Paris). Compt. rend. soc. biol. 153, 291-3(1959). (In French)

The effects of different doses of whole-body x irradiation on the speed of the closing of open skin wounds and the possibility of the regeneration of skin tissue by the irradiated animal were investigated. Doses less than 300 r increase the speed of closing principally during the period of contraction. Doses of 400 r have the same effect, but the acceleration of the wound closing is caused by the effect on the contraction phase. In animals submitted to 500 r or more, three concurrent phenomena appear: infection of the wound, impossibility for the animal to repair the wound, and the death of the animal. (tr-auth)

17679

EFFECTS OF DESOXYCORTICOSTERONE ACETATE AND OF PREDNISOLONE ON RADIOINDUCED STOMACH ULCERS IN THE RABBIT. J. Haot (Université, Liége). Compt. rend. soc. biol. 153, 354-6(1959). (In French)

Rabbits were irradiated with a single dose of 1500 r on the epigastric region. At various times after the irradiation, the rabbits received varying injections of prednisolone or desoxycorticosterone acetate. The results show that the immediate administration of prednisolone has a protective effect against the formation of ulcers, but if it is administered after the formation of the ulcers, it assists perforation. Doses of prednisolone less than 1.25 mg/kg of weight per day had no effect on the radioinduced ulcers. Desoxycorticosterone acetate had no effect under the experimental conditions used. (J.S.R.)

17680

INFLUENCE OF THE RATE OF EARLY MORTALITY AFTER IRRADIATION ON THE TOTAL SURVIVAL AND THE INCIDENCE OF RADIOLEUKEMIA IN THE C57 BL MOUSE. D. J. Mewissen (Oak Ridge Inst. of Nuclear Studies, Tenn. and Université, Liége). Compt. rend. soc. biol. 153, 366-70(1959). (In French)

It has been shown that the administration of cysteamine or cystamine before whole-body irradiation protects the C57BL mouse against early death but does not decrease the incidence of early leukemia. An attempt was made to find a relationship between survival and radioleukemia. Mice were exposed, at the age of 38 ± 3 days, to four successive doses of 160 r at intervals of seven days. The first lot was irradiated without further treatment. A second group received streptomycin orally in the drinking water. Cysteamine was administered intraperitoneally before each irradiation to the third group. A fourth group was treated as the third with the addition of oral administration of streptomycin. A fifth non-irradiated group were controls. Both streptomycin and cysteamine have a protective effect on the irradiated animals. On the 90th day, the percentage of lymphosarcomas was 56, 60, 52, and 54% in the survivors. Up to the 500th day, the incidence of radioleukemia among the survivors is practically identical in the four protected groups. (J.S.R.)

17681

PROTECTIVE EFFECT OF RIBONUCLEIC ACID AND RIBONUCLEINATES IN THE WHITE RAT IRRADIATED IN TOTO. J. Maisin, A. Dunjic, P. Maldague, and L. Deckers-Passau (Université catholique, Louvain, Belgium). Compt. rend. soc. biol. 153, 379-81(1959). (In French)

The protective effects of ribonucleic acid and sodium ribonucleinate against 500 r of whole-body x radiation were investigated using white rats. The acid and sodium salt were injected intraperitoneally 15 min before the irradiation. The results showed that both compounds had a protective effect. The acidity of the solution injected did not appear to have any effect on the protective properties of ribonucleic acid and sodium ribonucleinate, however the addition of sodium hydroxide destroys the protective action of ribonucleic acid. (J.S.R.)

17682

LETHAL EFFECTS OF X RAYS ON CALANDRA GRANARIA L. Michel Mortreuil (Office de la Recherche scientifique et technique, Paris). Compt. rend. soc. biol. 153, 393-4(1959). (In French)

Up to 2,000 r of x rays does not cause any lethal effect on Calandra granaria L. irradiated in the adult stage. Above 2000 and up to 25,000 r, the average survival of populations depends on the dose received. Irradiation above 25,000 r causes a mortality in insects more and more rapid. An irreversible inhibition in the reproductive apparatus was noted. There also seemed to be modifications of the digestive apparatus and nervous system. (tr-auth)

17683

POSSIBLE EFFECTS ON CUTANEOUS REGENERATION IN IRRADIATED WHITE RATS. G. C. Velley and M. Rostin (Faculté des Sciences et Centre de Recherches de Cytophysiologie, Paris). Compt. rend. soc. biol. 153, 407-9(1959). (In French)

The effects were studied of injections of properdin and of homologous or heterologous fetal bone marrow on the speed of healing in irradiated animals, on the course of the infection at the level of a skin wound, and on survival at the thirtieth day of the experiment. The injection of 250 units of properdin prevented infection of the wound in 100 of 100 animals irradiated to 500 r, and in 60 of 100 animals irradiated to 600 r. The experiments do not allow a conclusion as to the protective power of properdin against mortality in the rats. The bone marrow injections were effective in the cutaneous healing, in the fight against infection, and on the survival of the animals. (tr-auth)

17684

THE ROLE OF THE NERVOUS SYSTEM IN THE RADIOINDUCED ALTERATION OF HISTO-HEMATIC BARRIER PERMEABILITY. L. S. Stern, S. J. Rapoport, and M. M. Gromakovskaya. Doklady Akad. Nauk S.S.S.R. 126, 699-702(1959) May 21. (In Russian)

The role of the nervous system in radioinduced alterations of histo-hematic barrier permeability and the effects of neurotropic drugs administered before and after exposure to irradiation were analyzed. (R.V.J.)

17685

CHANGES TAKING PLACE IN THE INCLUSION AND DISTRIBUTION OF RADIOACTIVE PHOSPHORUS P^{32} IN THE NERVOUS SYSTEM TISSUE OF WHITE RATS. A. A. Manina (Inst. of Experimental Medicine, Academy of Medical Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 867-9(1959) June 1. (In Russian)

A morphological analysis was made of the radioactive P^{32} inclusion and distribution in the nervous system tissues of embryos (10-day old) and mature white rats. The dynamics of the concentration process in various neuron areas of the central nervous system was studied after 10 days. Comparisons of the P^{32} concentration in the cerebellum tissue of newly born and 10-day old animals showed the maximum inclusion in the newly born animals. The autographic investigations indicated that the penetration of P^{32} into the central nervous system is a gradual process. The maximum concentration in all investigated nervous system areas except the white substance was reached after 200 hours. In the white substance, inclusion is slower and continues to increase after 240 hours. The dynamics of P^{32} concentration and distribution is analogous in young and mature animals. The embryo brain tissues absorb the phosphorus irregularly. The P^{32} concentration increases with embryo growth and with differentiation of the brain element cells, reaching a maximum at birth. (R.V.J.)

17686

RELAXATION OF GLYCOGEN CONTENT ALTERATION IN THE LIVER OWING TO IONIZING RADIATION DURING THE IRRADIATION OF ANIMALS IN A CARBON MONOXIDE ATMOSPHERE. B. M. Graevskaya. Doklady Akad. Nauk S.S.S.R. 126, 874-5(1959) June 1. (In Russian)

The effects of carbon monoxide on the alterations in liver tissue glycogen content were studied in animals exposed to lethal doses of irradiation. The experiments were carried out with 195 female and male 8 to 12 weeks old mice weighing 18 to 25 g each. One group was irradiated in a standard atmosphere and the other in an atmosphere containing 0.5 vol. % carbon monoxide. The death rate was 96.9% among the unprotected mice and 24% among the protected mice. The glycogen content in unprotected mice increased during the first 48 hours, after which it steadily dropped, while in the protected animals the glycogen content neither increased or decreased. Consequently, carbon monoxide protection not only increases the rate of survival but also prevents the alteration of glycogen content. (R.V.J.)

17687

THE EFFECT OF ANTIHISTAMINE PREPARATIONS ON THE DEVELOPMENT OF SOME EARLY RAY DISTURBANCES. M. M. Gromakovskaya, E. I. Krichevskaya, and S. Ya. Rapoport (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 876-9(1959) June 1. (In Russian)

Studies of the effects of antihistamine preparations on free histamine levels and on histaminopexic ability of animal tissue showed that the preparations reduce the radiation effects by lowering the free histamine level of the skin. The effects of antihistamine drugs on the histo-hematic barrier penetrability in irradiated animals studied with P^{32} indicator injected (4 μ Cu) immediately following irradiation are tabulated. The results indicate that the antihistaminic drugs, injected 15 to 20 min before exposure, prevent the changes in histo-hematic barrier penetrability in liver, kidneys, and brain. The data show that antihistamine drugs administered prior to irradiation protects the animal from the increase of free histamine level, protects the histo-hematic barrier penetrability against radiation effects, prevents changes in autonomic nervous system functions, and relaxes early radiation injuries to bone marrow. (R.V.J.)

17688

THE EFFECT OF γ-RAYS UPON THE CONTENT OF SULFHYDRYL COMPOUNDS IN POTATO TUBERS. N. P. Korableva (Bakh Inst. of Biochemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 880-3(1959) June 1. (In Russian)

The effects of ionizing radiation on structural changes in molecular albumin and on the organic exchange of reserve materials in the plant were studied as well as means of utilizing ionizing radiation for lengthening the storage time of potatoes and plants. It was found that γ radiation alters the level and sequence of biochemical processes. The changes in physicochemical properties and in the level of oxidation-reduction processes are studied. (R.V.J.)

17689

VARIATION IN CHOLINESTERASE ACTIVITY IN TISSUES OF RATS AT DIFFERENT TIMES AFTER IRRADIATION. S. R. Zubkova and N. M. Chernavskaya (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1114-17(1959) June 11. (In Russian)

It was found that a single lethal dose (1000 r) changes the cholinesterase activity in the brain, liver, and blood serum. After 5 hr and 45 min the cholinesterase activity in tissues drops from the normal level (15.9% in blood serum, 20.6% in the brain, and 18.4% in the liver). After three days the activity changes in various tissues: in the liver it continues to drop, in the brain it rises but does not reach the standard level, and it increases sharply in the blood serum. (R.V.J.)

17690

PRACTICAL ASPECTS OF PROTECTION AGAINST RADIATION IN LABORATORIES USING RADIOELEMENTS. Jacques Pradel (Commissariat a l'Énergie Atomique, Paris). Énergie nucléaire 1, 77-84(1959) May-June. (In French)

The manipulation of radioelements presents danger both from external irradiation and from contamination. Against the former, shields of various compositions and thicknesses are used depending on the nature and activity of the radioactive source. Protection against contamination poses more complex problems. The principal protective equipment used is described: ventilated hoods, glove boxes, boxes with grips, and telemanipulators. The basic principles of the idea and of the management of the protective structure and of containment of the manipulation are pointed out. The rules to be observed in manipulating radioelements are reviewed as well as the means of controlling irradiation and contaminations. (tr-auth)

17691

EFFECT OF X-IRRADIATION ON THE DNA CONTENT OF INDIVIDUAL NUCLEI OF RABBIT BONE MARROW. E. M. Uyeki, Cecilie Leuchtenberger, and P. R. Salerno (Western Reserve Univ., Cleveland). Exptl. Cell Research 17, 405-13(1959) June.

Feulgen microspectrophotometric studies of DNA were conducted on individual nuclei of non-irradiated and irradiated femoral marrows of rabbits exposed to 800 r hemi-body x irradiation. The major portion of the measured marrow nuclei from the non-irradiated marrow cells are in the range between 6 and 12×10^{-9} mg of DNA per nucleus. These cells have been designated as synthesizing cells. The main consequence of x irradiation to the exposed femurs has been to reduce the num-

ber of synthesizing cells. Studies conducted at 24 and 48 hours post-irradiation reveal a consistent decrease in the number of synthesizing cells. At intervals of x irradiation less than 24 hours, the results were variable although indicative of a decrease in synthesizing cells. Studies on comparable nuclear sizes of x-rayed and non-x-rayed femoral marrow reveal a reduction of synthesizing cells in the larger nuclei. In the case of nuclear size ranges below 2.7 and erythroblasts there are no significant effects of x irradiation. (auth)

17692

EFFECT OF NITRIC OXIDE ON THE PRODUCTION OF CHROMOSOMAL ABERRATIONS BY X-RAYS. B. A. Kihlman (Univ. of Uppsala). Exptl. Cell Research 17, 588-90(1959) June.

Results are reported from a study of the effects of nitric oxide concentration on the radiosensitivity of root tips of the broad bean, Vicia faba, as demonstrated by chromosomal aberrations. (C.H.)

17693

THE EFFECT OF IRRADIATION ON INHIBITION OF THE GRAFT REACTION AGAINST THE HOST. A. Puza, E. A. Zotikov, and A. G. Babayeva (Czechoslovak Academy of Sciences, Prague and Academy of Medical Sciences of the U.S.S.R., Moscow). Folia Biol. (Prague) 5, 186-9(1959).

Skin from adult cocks was transplanted to the allantochorion of chick embryos. After seven days the grafts induced experimental splenomegaly in the recipients. This phenomenon was used as the indicator of immunological activity of the graft after irradiation in vitro. A dose of 1,000 r caused a statistically significant decrease in the reaction of the graft against the host, while the vitality of the graft was maintained. Both irradiated and nonirradiated skin grafts took throughout and were vascularized. (auth)

17694

THE EFFECT OF PYRIMIDINE DEOXYRIBONUCLEOTIDES ON THE HAEMATOPOIETIC TISSUE OF IRRADIATED MICE. J. Soška, Z. Karpfel, and V. Drášil (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 5, 190-8(1959).

Experiments were carried out in mice irradiated with 500 r, investigating stimulation of regeneration of hematopoiesis by certain nucleotides and -sides injected after irradiation. The results were evaluated by survival, the blood picture, the mitotic index in the bone marrow, and DNA synthesis in the spleen. Pyrimidine deoxyribonucleotides had a positive effect, while under the given conditions the other substances tested (pyrimidine deoxyribonucleosides, purine deoxyribonucleotides and some ribonucleotides) did not promote regeneration. The authors assume that pyrimidine deoxyribonucleotides are one of the factors determining physiological proliferation of hematopoietic cells or spontaneous regeneration of hematopoiesis after irradiation. (auth)

17695

ADMINISTRATION OF PERIPHERAL NEUROTROPHIC AGENTS IN THE PROPHYLAXIS OF RADIATION SICKNESS. L. F. Semenov (Inst. of Experimental Pathology and Therapy, Academy of Medical Sciences, U.S.S.R., Suchumi). Folia Biol. (Prague) 5, 204-10(1959).

Experiments were carried out in 5,582 mice irradiated with a total-body dose of 700 r, and the prophylactic effect of pharmacological substances chiefly affecting the peripheral parts of the nervous system was studied. Among these compounds, the stimulators had a protective effect, while paralyzing or blocking agents were usually ineffective. The best protective effect was provided by a combination of the two peripheral stimulators adrenaline and acetylcholine (survival 36%). The protective effect of this combination is associated with the peripheral sympathicotropic action of adrenaline and the mainly M-cholinergic effect of acetylcholine. These substances evidently act via intermediary metabolic products, which can themselves be used as protective anti-radiation agents. (auth)

17696

RADIATION SICKNESS IN MAMMALS FOLLOWING IRRADIATION OF THE FACIAL PART OF THE HEAD. L. F. Semenov and B. A. Fedorov (Inst. of Experimental Pathology and Therapy, U.S.S.R., Academy of Medical Sciences, Suchumi). Folia Biol. (Prague) 5, 211-16 (1959).

In 232 guinea pigs the authors studied processes which developed after irradiation of different parts of the head with doses of 2,400 to 20,000 r. Irradiation of the whole head or of the facial part only, with doses of 2,500 to 4,000 r led to acute radiation sickness, with death of 50 to 100% of the animals at a given stable time (7 to 10 days). Under these conditions, marked leucopenia (2,500 to 3,000 cells mm^3), moderate hypoplasia of non-irradiated hematopoietic tissue, marked involution of the thymus gland, hyperplasia of the adrenals and thinning of the mucous membrane of the small intestine were observed. Irradiation of the cerebral area with the same doses, or with doses up to 10,000 r, did not lead to the development of acute radiation sickness or to death. Severe radiation injury was observed at the site of irradiation. The development of severe radiation sickness and death following irradiation of the facial part of the head, without direct irradiation of vital organs, is important evidence supporting the hypothesis of the reflex mechanism of the development of acute radiation sickness. (auth)

17697

THE ELECTRIC CONDUCTIVITY OF SURVIVING TISSUE AFTER X-IRRADIATION FROM THE STANDPOINT OF THE KINETICS OF OPEN SYSTEMS. J. Kryšpín and Z. Harantová (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 5, 231-4(1959).

A biological model was constructed to demonstrate the electric conductivity of irradiated tissues. The ohmic resistance of the tissue was chosen to indicate the changes in the steady state of irradiated tissues. The changes induced in dynamic equilibrium in surviving tissues were studied under defined conditions. Reaction mechanisms are discussed. (C.H.)

17698

JOINT CARTILAGE DAMAGE AFTER X IRRADIATION. J. Kolář and R. Vrabec (Karls-Universität, Prague). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 90, 717-21(1959) June. (In German)

The clinical course and radiographic appearances of Roentgen arthritis—arthritis sicca post actinotherapiam—are described on the basis of twelve cases. The arthritis is regarded as an independent process resulting from radiation damage. (auth)

17699

ABSORPTION OF 20 TO 250 kv X RADIATION IN TISSUE. H. Oeser, E. Krokowski, and H. Broy (Freien Universität, Berlin). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed. 90, 734-7(1959) June. (In German)

The results of absorption measurements in different body tissues for x rays between 20 and 250 kv and their

significance for diagnosis are discussed. In the radiograph of the military hemosiderosis in the chest the hemosiderin plays no significant part. (auth)

17700

THE MUTABILITY OF 18 Mev ELECTRONS APPLIED TO DROSOPHILA SPERMATOZOA. I. H. Herskowitz, H. J. Muller, and John S. Laughlin (Indiana Univ., Bloomington and Memorial Center for Cancer and Allied Diseases, New York). Genetics 44, 321-7 (1959) May.

Sperm in inseminated females were either untreated or treated with 600, 1500, or 3750 rads of 18 Mev electrons and different types of mutation involving the paternal chromosomes were detected among the offspring. Partial or complete sex chromosome loss increased slightly, but significantly, faster than linearly with dose; II–III reciprocal translocations increased approximately as the $^3/_2$ power of the dose; and sex-linked recessive lethal mutations increased approximately linearly with dose. The shapes of all three curves are in good agreement with previous x-ray results. (auth)

17701

INDUCED CHANGES IN FEMALE GERM CELLS OF DROSOPHILA. VI. THE EFFECT OF DEHYDRATION UPON THE X-RAY-INDUCED FREQUENCIES OF CROSSOVER-LIKE EXCHANGES AND OF GROSS CHROMOSOMAL REARRANGEMENTS. Irwin H. Herskowitz (St. Louis Univ.). Genetics 44, 329-39 (1959) May.

Dehydration of D. melanogaster females significantly increases the rate of crossover-like exchanges induced by x rays in the proximal region of the X chromosome (between carnation and the centromere). This dehydration effect was found in eggs laid both at the beginning and end of the first eight days after irradiation, that is, periods when the eggs at the time of irradiation were past, and before or during, the stage of spontaneous crossing over, respectively. The frequency of gross chromosomal rearrangements, as detected by detaching attached-X's, induced by x rays is also increased by prior maternal dehydration. These results permit the hypothesis that the increase in egg mortality, obtained earlier when dehydration preceded x raying, has a genetic basis, and that on this view it is to be considered as resulting from dominant lethal mutations. Although no cytological study was made, it is suggested that the dehydration effect may have been produced by shrinking nuclei, resulting in an increased chance for broken ends to interchange rather than restitute. (auth)

17702

ALLELISM, COMPLEMENTATION, AND PSEUDOALLELISM AT THE DUMPY LOCUS IN DROSOPHILA MELANOGASTER. Elof Axel Carlson (Indiana Univ., Bloomington). Genetics 44, 347-73(1959) May.

Four, and probably at least seven, subloci are present in Drosophila in the dumpy region. The difference between the effects of the cis and trans combinations of these mutants does not seem to be directly related to the linear distance between subloci within the dumpy region nor to the exchange of products between paired homologous chromosomes. Pseudoallelic subloci expressing a recessive lethal effect in the dumpy region are suggested. Recombination has thus far not resolved the pleiotropic effects of individual subloci into finer subunits. No suggestive evidence of "gene conversion" or aberrant recombination for this region has thus far been obtained. Heterochromatic position effects associated with the dumpy region can be uniquely distinguished and demonstrated. Mutation rates of the various mutant types differ considerably, with multiple effect phenotypes more common than single effect phenotypes. Each mutant in the nest can be demonstrated to show at least a weak expression of the other remaining characteristics of this series by means of special modifiers and other genetic techniques. The developmental processes resulting in the oblique, lethal, and vortex expressions of the dumpy series are separate in time. A single gene model seems to provide a possible basis for this series, although features are to be found in it (evidence for subgenes) that do not seem to be present in bacteriophage cistrons. Whether the dumpy subgenes arose by duplication from one another is still an open question. (auth)

17703

NUCLEIC ACID METABOLISM AND RIBONUCLEIC ACID HETEROGENEITY IN ESCHERICHIA COLI. Joan L. Countryman and Elliot Volkin (Oak Ridge National Lab., Tenn.). J. Bacteriol. 78, 41-8(1959) July.

Nucleic acid synthesis in normal broth-grown cultures of Escherichia coli strain B is characterized by a rapid increase in the ribonucleic acid-deoxyribonucleic acid (RNA : DNA) ratio during the lag phase; this becomes constant in the logarithmic phase and declines in the stationary phase when RNA synthesis comes to a halt. P^{32} is incorporated into RNA and DNA phosphorus at any culture age, but to relative extents consistent with the corresponding synthetic activity of the cells. No RNA or DNA turnover could be demonstrated. As with RNA from T2-infected bacteria, normal bacterial RNA appears to be heterogeneous in that ribonucleic acids dissimilar in specific activity are isolated when cells briefly exposed to P^{32} are disrupted and separated into two particulate fractions (P_1 and P_2) and a soluble fraction (S). RNA in the P_1 fraction constitutes less than 5 per cent of the total RNA, but attains the highest specific activity; RNA in the soluble fraction is intermediate. When the isotope is removed after a short incorporation by cells in the logarithmic phase, there is an immediate and continuing drop in the specific activity of P_1-RNA, but the specific activities of the RNA of P_2 and the soluble fraction continue to rise for at least another 5 min before declining. After P^{32} incorporation, the RNA mononucleotides in the P_1, P_2, and soluble fractions from normal bacteria are uniformly labeled. On the contrary, in each fraction obtained from T2-infected cells, adenylic and uridylic acids contain almost twice as much isotope as cytidylic and guanylic acids. However, the mononucleotide composition of each RNA fraction from T2-infected cells is the same as that of the fractions from normal bacteria. (auth)

17704

A STUDY OF CERTAIN INDICES OF NATURAL IMMUNITY IN DOGS AFFECTED BY POLONIUM, UNDER CONDITIONS OF COMBINED THERAPY. I. A STUDY OF THE INTESTINAL MICROFLORA. O. R. Nemirovich-Danchenko. J. Microbiol., Epidemiol. Immunobiol. (USSR) (English Translation) 29, 1790-7 (1958).

The subcutaneous injection of polonium in a dose of 0.05 mc/kg body weight caused severe radiation sickness in dogs. Changes were observed in the intestinal microflora. These included a fall in the number of typical E. coli and an increase in the proportion of hemolytic strains among the intestinal flora, a rise in the

number of atypical strains of E. coli, and a rise in the numbers of Cl. perfringens during the first few days of radiation sickness. The institution of combined therapy led to some improvement in the general condition of the animals, increased their survival time, suppressed the development of local inflammatory changes at the site of injection of the polonium and led to the relative normalization of the microflora of the large intestine. (auth)

17705

THE RELATIONSHIP BETWEEN THE METABOLIC POOLS OF PHOTOSYNTHETIC AND RESPIRATORY INTERMEDIATES. V. Moses, O. Holm-Hansen, J. A. Bassham, and M. Calvin (Univ. of California, Berkeley). J. Mol. Biol. 1, 21-9(1959).

Using radioactive carbon dioxide, an attempt has been made to distinguish the various pools of intermediary metabolism which may be physically or chemically separate within the cell. Some correlation between the structural elements of the cells and these pools appears possible. (auth)

17706

TRANSPLANTATION OF HOMOLOGOUS AND HETEROLOGOUS LYMPHOID CELLS IN X-IRRADIATED AND NON-IRRADIATED MICE. O. Vos, M. J. DeVries, J. C. Collenteur, and D. W. Van Bekkum (National Defense Research Council TNO, Ryswick, Netherlands). J. Natl. Cancer Inst. 23, 53-73(1959) July.

The injection of a large number of homologous lymphoid cells kills x-irradiated mice protected with isologous or homologous bone marrow within 1 to 2 weeks. The injection of a smaller number of homologous lymphoid cells kills the mice after a longer interval. Parental-strain lymphoid cells have a detrimental effect in irradiated F_1 hybrids, but F_1 hybrid lymph-node cells produce no ill effect in parental-strain mice. Rat lymph-node cells only have a lethal effect in irradiated mice protected with heterologous bone marrow when the cells are injected at 24 hours after irradiation. On the basis of the number of cells required to produce a certain percentage of mortality, homologous lymph-node cells are somewhat more effective than homologous spleen cells, but much more effective than homologous thymus cells. Mice that died 10 to 20 days or later after injection of homologous or heterologous lymphoid cells had symptoms and lesions which resembled those seen in mice that died from the secondary disease after foreign bone marrow transplantation. A pathological syndrome resembling the secondary disease has been evoked in a certain number of nonirradiated F_1 hybrid mice by the injection of a large number of lymphoid cells from parental strain mice that had been sensitized against isoantigens of the other parental strain. These observations support the concept of a graft-antihost reaction that is involved in the development of secondary disease. (auth)

17707

THE PATHOGENESIS OF THE SECONDARY DISEASE AFTER FOREIGN BONE MARROW TRANSPLANTATION IN X-IRRADIATED MICE. D. W. Van Bekkum, O. Vos, and W. W. H. Weyzen (National Defense Research Council TNO, Ryswick, Netherlands). J. Natl. Cancer Inst. 23, 75-89(1959) July.

The available information on the pathogenesis of the secondary disease after foreign bone marrow transplantation in irradiated mice is reviewed. Additional experiments are reported. The incidence of secondary disease after foreign bone marrow transplantation in mice was studied in various host-donor combinations after irradiation at three dosage levels. A characteristic secondary mortality was observed in CBA mice that received isologous bone marrow after the larger doses of x rays. Secondary mortality did not occur in F_1 hybrid mice that received isologous bone marrow, but severe diarrhea developed after the higher doses of x rays when followed by treatment with parental-strain bone marrow. In mice treated with rat bone marrow the development and persistance of symptoms of secondary disease was correlated with the presence of a functional rat bone marrow. Skin lesions and wasting, typical of secondary disease, as well as a high rate of mortality were observed in F_1 mice after the establishment of a parabiotic junction with a parental strain mouse of the same sex and age. Evidence has been provided in support of the hypothesis that the secondary disease in mice treated with foreign bone marrow is due to the combined effects of late radiation damage, an immunological reaction of the graft against the host, and an impaired immunological defense against microörganisms. (auth)

17708

IMMUNOGENETIC STUDIES ON X-IRRADIATED MICE TREATED WITH HEMATOPOIETIC CELLS AND GRAFTED WITH TUMOR TISSUES. Michael Feldman and David Yaffe (Weizmann Inst. of Science, Rehovoth, Israel). J. Natl. Cancer Inst. 23, 109-31(1959) July.

A study was made of the behavior of tumor grafts in the radiation chimera to analyze the immune reactivity of the donor's hematopoietic cells and the influence on tumor cells of the radiation chimera. The regression of homografts of Sarcoma C10 and Sarcoma MC1M (of C3H origin) in irradiated C57BL animals treated with C57BL cells and their progressive growth in irradiated animals treated with C57BL fetal hematopoietic cells gave evidence of the ability of donor cells to form transplantation immunity against foreign antigens, thus substantiating the graft versus host theory as the basis for homologous secondary disease. Tumor grafts produced metastases in irradiated animals, and irradiation and immunogenetic factors were shown to influence their development. The transplantation of Sarcoma SBL1 into various types of genetic chimeras was accompanied by immunogenetic changes in the tumor, which were manifested by the loss of strain specificity. The effect of total-body irradiation of the host and the absence of isologous C57BL cells were shown to be the main factors determining this change. Their analysis provided definite indications that the acquired homotransplantability of SBLx sublines is basically a result of immunogenetic transformation induced by the host and not a result of selection of pre-existing compatible cell variants. (auth)

17709

IMMUNOGENETIC CHANGES INDUCED IN TUMORS GROWN IN RADIATION CHIMERAS. David Yaffe and Michael Feldman (Weizmann Inst. of Science, Rehovoth, Israel). J. Natl. Cancer Inst. 23, 133-51(1959) July.

An analysis was made of the immunogenetic properties of SBLx tumor lines that had acquired homotransplantability by growing in radiation chimeras. This study mainly concerned the nature of the induced change and the mechanism of homotransplantability acquired. The SBLx tumors had lost the original antigenicity of SBL1, and the homotransplantability of SBLx was thus based on its inability to elicit an immune response. SBLx homografts, however, were found to be highly

susceptible to transplantation immunity. Thus, the low antigenicity of the tumor cells was not due to the loss of the H antigens, but was attributed to a low rate of antigen emission. The analysis of these properties provided evidence that the change of SBL1 to SBLx involved a genetic transformation induced by the conditions that prevailed in the radiation chimeras. The acquired homotransplantability was found to be a reversible process. Transplantation of SBLx tumors back into C57BL or into (C3H × C57BL)F_1 mice resulted in a complete loss of homotransplantability. The mere existence of the isologous C57BL antigens in the host was sufficient to produce this reversed change, and the SBLxB1 tumors thus formed regained the original antigenicity of SBL1. This reversed process took place only if the SBLx tumor was transplanted to hosts of foreign strains following 9 to 16 days of growth in C57BL mice. Prolonged growth of the tumor in C57BL mice did not result in the loss of strain specificity. The significance of these data in relation to the possible mechanism of the reversible change is discussed. (auth)

17710

ON THE PARTICIPATION OF THE VEGETATIVE NERVOUS SYSTEM IN THE ORGANISM'S REACTION TO THE EFFECT OF IONIZING RADIATION. A. V. Lebedinskii, Z. N. Nakhilnitskaya, and N. P. Smirnova. Med. Radiol. 4, No. 7, 3-9(1959) July. (In Russian)

Literature data are reviewed and the results are given of investigations on the problem of the participation of the vegetative nervous system in the reaction of the organism to irradiation. The cited data serve as evidence of the peculiarities of adaptational reactions of the vegetative nervous system in conditions of ionizing radiation in contradistinction to those with the action of other factors of the external environment. These specific features are associated in the first place with functional disturbances in the vegetative nervous system itself, its central and peripheral formations, and, in the second, with disturbance of mechanisms of its inclusion into the reaction of the organism. Here there is a possibility of a direct action of radiation on the centers, the absence of mobilization of the cortical component in effecting the vegetative reflexes, and disturbance of neuroendocrine mechanisms. As a result of the above the adaptational reactions of the organism to the action of ionizing radiation prove inferior, and occasionally perversed. (auth)

17711

PECULIARITIES OF RABBITS' REACTION TO IRRADIATION DEPENDING UPON THE FUNCTIONAL STATE OF THEIR NERVOUS SYSTEM. S. B. Balmukhanov (Kazakh Medical Inst.). Med. Radiol. 4, No. 7, 10-13 (1959) July. (In Russian)

Immediately after total irradiation there develops in rabbits a hyperglycemic reaction. The degree of the hyperglycemic reaction depends upon the initial level of blood sugar: in a high content of sugar there is a high hyperglycemic coefficient and vice versa. Inhibition of the central nervous system in urethane anesthesia leads to the intensification of the hyperglycemic reaction in the irradiated animals. A high blood sugar content (hyperglycemic coefficient 1:1.5 to 2) is noted immediately after the irradiation and this high level is maintained for 5 to 6 hours. In the irradiated rabbits the adrenaline effect intensifies: the hyperglycemia caused by the introduction of adrenaline is more pronounced and prolonged in the irradiated animals than in the controls. The degree of adrenaline hyperglycemia in animals subjected to irradiation during urethane anesthesia does not show any essential difference. (auth)

17712

THE INFLUENCE OF ULTRA-HIGH-FREQUENCY ELECTRIC FIELD ON THE COURSE OF EXPERIMENTAL RADIATION SICKNESS IN ANIMALS. N. A. Vladimirova (Central Inst. for Advanced Training of Physicians). Med. Radiol. 4, No. 7, 14-20(1959) July. (In Russian)

Studies were made of the influence of ultra-high-frequency electric fields on the processes of hematopoiesis, as well as on the course of radiation sickness. Seventy rabbits were under study. Radiation sickness was induced by total x irradiation (650 r) or by the introduction of radiophosphorus (1 mc/kg). The results of the investigations show that the action of ultra-high-frequency electric fields on the region of the liver, spleen, stomach, and other adjacent organs produces changes in the peripheral blood and bone marrow of rabbits affected with radiation sickness. Leukopoiesis and thrombopoiesis were the most affected in rabbits subjected to x irradiation, while reticulocytes and thrombocytes were most affected in those given radiophosphorus. (auth)

17713

CHANGES OF CERTAIN INDICES OF THE BLOOD COAGULATION SYSTEM IN RADIATION SICKNESS AND IN INTRODUCTION TO IRRADIATED ANIMALS OF A PREPARATION ISOLATED FROM THE SPLEEN. I. A. Pelishenko and V. V. Rudakova (Kirov Military Medical "Order of Lenin" Academy). Med. Radiol. 4, No. 7, 20-6(1959) July. (In Russian)

Experiments were staged on rats subjected to x rays (600 r). On the 8th day following irradiation there was a sharply marked thrombopenia, a reduced consumption of prothrombin, and a higher blood coagulation time. The preparation, isolated from the spleen by Savitsky's method, partially normalizes the disturbances in the blood coagulation system, which is seen by the increased number of thrombocytes (37%) and by a drop of the blood coagulation time (12%) as compared with the control irradiated animals. It is shown that the disturbance of the thromboplastic activity of the blood, determined by the consumption of prothrombin, cannot be due only to thrombopenia. The determination of prothrombin consumption is recommended as a sensitive test for the assessment of the state of the blood coagulation system in radiation sickness, inasmuch as this test characterizes the thromboplastic activity, which depends upon many factors. The determination of the latter does not always show the real picture of the complex process of blood coagulation. (auth)

17714

INDICES OF THE HEMORRHAGIC SYNDROME AND CHANGE OF THE 17-KETOSTEROIDS CONTENT IN THE URINE IN ACUTE RADIATION SICKNESS. E. N. Antipenko. Med. Radiol. 4, No. 7, 26-31(1959) July. (In Russian)

Comparison was made of the usual hemorrhagic syndrome with the change in contents of the final products of metabolism of the hormone of the suprarenal cortex. The hemorrhagic syndrome in acute radiation sickness in dogs, caused by irradiation in the dose of 400 r, has no connection with exhaustion of the function of the suprarenal cortex, at least to the degree that it is reflected in the contents of 17-ketosteroids in the urine. The decrease of permeability and fragility of capillaries which is noted at the period of recovery from radiation

sickness is, possibly, connected with the increased activity of the suprarenal cortex. (auth)

17715

CHANGES OF REFLEXES FROM THE CAROTID SINUS IN ACUTE RADIATION SICKNESS. A. S. Mozzhukhin (Kirov Military Medical "Order of Lenin" Academy). Med. Radiol. 4, No. 7, 32-6(1959) July. (In Russian)

In acute and chronic experiments on rabbits subjected to radiocobalt irradiation (800 r), the reflexes from the carotid sinus on respiration, heart, and blood pressure were studied. Changes of the pressor reflex from the carotid sinus (decrease, disappearance, and perversion), observed in the period of primary reaction and at the height of acute radiation sickness, are of central origin and are connected, apparently, with disturbance of normal intercentral interrelations of reflexes with sinocarotid and aortic reflexogenic zones. (auth)

17716

THE FUNCTIONAL CONDITION OF ARTERIAL BLOOD VESSELS IN ACUTE RADIATION SICKNESS. V. I. Kuznetzov (Kirov Military Medical "Order of Lenin" Academy). Med. Radiol. 4, No. 7, 36-40(1959) July. (In Russian)

The tone of both elastic and muscular blood vessels was studied in acute radiation sickness. It was established that the tone of the arteries of the muscular type is greatly increased during radiation sickness. A suggestion was made on the significance of the changes in the arterial tone in the development of hemorrhages. (auth)

17717

THE INFLUENCE OF CYSTEINEAMINE ON THE RESPIRATION AND BLOOD PRESSURE (TO THE MECHANISM OF THE PROTECTIVE ACTION OF CYSTEINEAMINE). G. I. Smorodintseva (Inst. of Experimental Medicine). Med. Radiol. 4, No. 7 40-6(1959) July. (In Russian)

The influence of a therapeutic dose of cysteineamine on the blood pressure and respiration was studied. The investigations, staged on cats irradiated with 500 and 700 r, revealed that the best protective effect following the administration of cysteineamine took place when the dose amounted to 75 mg/kg. All the cysteineamine doses studied (30, 50, 75, and 100 mg/kg) produce a drop in the blood pressure and stimulation of respiration. The respiratory stimulation caused by cysteineamine introduction is weakened by cutting of the vagus nerves, denervation of carotid sinuses, or preliminary introduction of hexonium. (auth)

17718

THE MECHANISM OF VASCULAR PERMEABILITY DISTURBANCE IN RABBITS POISONED WITH TRITIUM. A. M. Ivanitsky. Med. Radiol. 4, No. 7, 47-52(1959) July. (In Russian)

Subcutaneous introduction of tritium (0.2 curie/kg) to rabbits causes a moderate increase of vascular permeability. The administration of adrenaline lowers the permeability. In rabbits subjected to tritium the action of adrenaline is more pronounced than in healthy animals. Acetylcholine, which raises the permeability in normal conditions, decreases it somewhat in the affected rabbits. Novacain facilitates the vascular permeability increase in the affected rabbits, as compared with its decrease in the healthy animals. The data obtained may testify in favor of the protective role of the nervous system, its sympathetic portion in particular, which is manifested in the increase of the permeability in rabbits subjected to the action of tritium. (auth)

17719

THE INFLUENCE OF INTRODUCTION OF BONE MARROW SUSPENSION OF THE IMMUNITY OF IRRADIATED ANIMALS. M. A. Tumanyan and A. V. Izvekova (Gamalei Inst. of Epidemiology and Microbiology). Med. Radiol. 4, No. 7, 52-9(1959) July. (In Russian)

Experimental investigations show that daily protracted (20 to 25 days) treatment with bone marrow following the action of ionizing radiation stimulates hematopoiesis. Prolonged daily administration of bone marrow of nonirradiated rats (80 to 100 million cells) into the irradiated rats increases the number of leukocytes, erythrocytes, thrombocytes, and reticulocytes in comparison with the control. The introduction of bone marrow raises the sharply lowered natural resistance of rats to typhoid bacteria due to the influence of ionizing radiation. Bone marrow administration to rats irradiated with LD100 of gamma-rays increases their survival rate up to 30%. Although the treatment of irradiated rats with antibiotics and bone marrow does not increase their survival rate as compared with the irradiated rats treated only with antibiotics, however, the above treatment produces the most favorable effect of protection of the irradiated organism from infectious complications of radiation sickness. (auth)

17720

THE INFLUENCE OF EXTERNAL OR INTERNAL IRRADIATION ON THE EFFICACY OF THE ANTIPERFRINGENS SERUM. L. G. Kovtunovich (L'vov Inst. of Epidemiology, Microbiology, and Hygiene). Med. Radiol. 4, No. 7, 59-62(1959) July. (In Russian)

White mice were subjected to external (x rays) or internal (P^{32} administration) irradiation in lethal or sublethal doses in studies of the efficacy of the antiperfringens serum, which was introduced immediately or 1 to 4 hours following the intravenous injection of IDCL B. perfringens toxin. As was established, the efficacy of the antiperfringens serum did not change after a preliminary irradiation, being mainly dependent upon the duration of the interval between the introduction of the toxin and the use of the serum. (auth)

17721

THE CHANGE OF PHAGOCYTOSIS IN THE LUNGS IN RADIATION SICKNESS. A. E. Ivanov and N. N. Kurshakova. Med. Radiol. 4, No. 7, 62-6(1959) July. (In Russian)

The state of pulmonary phagocytes in rabbits subjected to irradiation in the dose of 800 r was studied. The phagocytosis was studied in the imprints and histological preparations of the lungs by introduction into the trachea of trypan blue during the life of the animals. The activity of oxidative enzymes (succindehydrase and cytochrome oxidase) was determined in the pulmonary macrophages with histochemical methods. The investigations were conducted in dynamics, starting from the 6th hour up to the 20th day following irradiation. It is shown that in radiation sickness there occurs a considerable decrease of phagocytic properties of pulmonary macrophages. The changes are of a phasic character, corresponding with the stages of radiation sickness development as a whole. The decrease of phagocytosis occurs as the result of diminution of the absolute number of macrophages and the loss of the ability to engulf foreign particles, as well as due to the disturbance of processes of intracellular digestion, which is evidenced by the drop of the activity

of oxidative enzymes. Inhibition of phagocytosis is, apparently, one of the principal causes of permeability of the lung barrier and the peculiarity of pneumonic changes in conditions of radiation sickness. (auth)

17722

THE EFFICACY OF BLOOD SUBSTITUTION WITH POLYGLUCINE IN EXPERIMENTAL TREATMENT OF RADIATION SICKNESS. M. N. Trushina. Med. Radiol. 4, No. 7, 67-70(1959) July. (In Russian)

The therapeutic effect was studied of two blood substitutions with polyglucine (10 to 11% of the total quantity of blood) on the first and third day following irradiation against the background of various therapeutic substances (antibiotics, antihemorrhagic and antihistaminic preparations, hemotransfusions). The experiments were staged on 21 dogs subjected to X-ray irradiation (600 r). The indices of effectiveness were the following: the survival of dogs, clinical symptomatology, and changes of the peripheral blood and autopsy data. In a number of animals the coagulation time, the permeability and resistance of skin capillaries, as well as the general content of protein in the blood serum was studied. As was established, the above variant of therapy considerably increased the survival of irradiated animals (of the 11 dogs under treatment 9 survived, of the 10 control dogs only 2 survived), alleviated the clinical course of acute radiation sickness, and favorably influenced the laboratory indices of hemorrhagic diathesis (blood coagulation, permeability, and resistance of skin capillaries). Additional experiments, staged on 10 dogs, with the exclusion of polyglucine transfusions from the complex of therapeutic measures, decreased by many times the therapeutic effect of treatment (of the 10 treated dogs only 3 survived, of the 7 controls only 2). Polyglucine transfusions considerably increase the efficacy of the complex treatment of acute radiation sickness. (auth)

17723

THE ACTION OF MERCAMIN ON THE LIVER (EXPERIMENTAL MORPHOLOGICAL RESEARCH). G. P. Elyashevich (Ministry of Health). Med. Radiol. 4, No. 7, 70-3(1959) July. (In Russian)

Numerous investigations have established that β-mercaptoethylamine upon prophylactic administration (150 mg/kg) before the irradiation protects the organism from radiation injuries. Along with this, it is known that the preparation is toxic. In experiments staged on mice the author studied the action of mercamin on the liver, as well as the survival of the irradiated animals. Altogether 270 mice were experimented upon. The preparation introduced in the above dose to non-irradiated animals provoked fatty degeneration of the liver. The administration of the preparation before the irradiation of animals also leads to fatty degeneration of the liver. This process is reversible, however, in animals, given the above preparation before the irradiation, the structure of the liver normalizes at a later date (on the 31st day), whereas the hepatic structure in the non-irradiated animals normalizes on the 20th day following the introduction of the preparation. The protective effect of β-mercaptoethylamine has been substantiated in the experiments. (auth)

17724

INVESTIGATION OF THE RECEPTORS OF THE IRRADIATED AREAS OF HUMAN BODY DURING RADIATION THERAPY. N. S. Delitsyna. Med. Radiol. 4, No. 7, 73-6(1959) July. (In Russian)

Investigations were carried out on persons subjected to the local action of x rays for the treatment of various diseases. At the time of the electroencephalographic recording the author performed tactile irritation of different areas of the body before and after the irradiation. Immediately following the irradiation there could be registered a change in the reaction of the cerebral cortex to tactile irradiation of the irradiated area. This testifies to the presence of changes in the peripheral neuroreceptor apparatuses of those areas of the body which were subjected to the direct action of the radiation factor. The change of the functional state of the central nervous system associated with the effect of local irradiation is also testified by the fact, that the reaction to tactile irritation of regions remote from the site of the irradiation changes, although to a considerably lesser degree. (auth)

17725

DOSIMETRIC PARAMETERS AND THE DISTRIBUTION OF DEPTH DOSES OF THE GUT-Co-20-1 GAMMA-APPARATUS. G. F. Novskaya. Med. Radiol. 4, No. 7, 76-80(1959) July. (In Russian)

A study was carried out of the therapeutic Gut-Co-20-1 telegamma-apparatus (Co^{60} — 20.9 g-eq. Ra). The distribution of radiation provides for a beneficial action of rays on tumors, located within 3.5 to 5.5 cm from the surface of the skin. At this depth conditions are created for uniform and considerable irradiation, while the tissues anteriorly and posteriorly of the tumor are within the region of weakened irradiation. It is preferable to employ the Gut-Co-20-1 apparatus for the treatment of tumors of the maxilla, tongue and oral cavity, cancer of the larynx and pharynx, primary and metastatic tumors of the neck, etc. The protective properties of the apparatus' head and camera are considered as unsatisfactory, however, they could be improved by substituting the lead head for a tungsten one, and employing Cs^{137} as a source of radiation instead of Co^{60}. (auth)

17726

THE RATE OF ADSORPTION OF GLYCINE FROM THE INTESTINE OF ANIMALS IN ACUTE RADIATION SICKNESS. I. V. Fedorov. Med. Radiol. 4, No. 7, 87-8(1959) July. (In Russian)

It was found that the rate of absorption of digested albumen products was not affected during the latent or acute periods of radiation sickness. In acute lethal radiation sickness the adsorption mechanism was not disturbed even during the final pathomorphological changes in the mucous membranes of the small intestine. (R.V.J.)

17727

THE CHANGE OF WATER-SALT EXCHANGE IN RADIATION SICKNESS OF RABBITS INDUCED WITH RADIOPHOSPHORUS. M. A. Khvoinitskaya (Kiev Inst. of Industrial Hygiene and Occupational Disease). Med. Radiol. 4, No. 7, 88-90(1959) July. (In Russian)

During the first 1 to 2 days of acute radiation sickness induced by lethal doses of P^{32} (2.5 μc/g), urine excretion increases, followed first by reduced and then by increased diuresis. The water content at various periods increases 0.6 to 3.6% in blood serum and 0.5 to 8.5% in whole blood. The content of chlorides in blood plasma and calcium in blood serum drops from the normal. (R.V.J.)

17728

ETHYL ALCOHOL—RADIOMIMETIC AGENT IN VICIA FABA L. A. Michaelis, K. Ramshorn, and R. Rieger (Deutschen Akademie der Wissenschaften,

Berlin). Naturwissenschaften 46, 381-2(1959). (In German)

The radiomimetic properties of ethyl alcohol on roots of Vicia faba L. were investigated. Root tips were placed in various concentrations of ethyl alcohol at 24°C for 24 hr. After a 24-hr recovery period in running water at 24°C, the roots were fixed in alcohol–glacial acetic acid solution with 0.05% colchicine. The chromosome mutations which had occurred at each concentration of ethyl alcohol were determined. The results, which are tabulated, show a correlation between alcohol concentration and chromosome aberration. (J.S.R.)

17729

THE Sr^{90} CONTENT OF DIFFERENT GRASSLAND SAMPLES IN THE FEDERAL DISTRICT IN RELATION TO Sr^{90} CONTENT OF THE SOIL. Albert Sittkus (Universität, Freiburg i. B.) and Erwin Welte (Landwirtschaftliche Forschungsanstalt Büntehof, Hanover). Naturwissenschaften 46, 399-400(1959) (In German)

The Sr^{90} content of plant materials was determined and compared to Sr^{90} content of the soils from which they were taken. Plotting plant Sr^{90} on the y-axis and soil Sr^{90} on the x-axis gives a straight line: $y = 0.173\times +0.70$. (T.R.H.)

17730

SEARCH FOR UNSTABLE CO_2 FIXATION PRODUCTS IN ALGAE USING LOW TEMPERATURE LIQUID SCINTILLATORS. Kofia Kasprzyk and Melvin Calvin (Univ. of California, Berkeley). Proc. Natl. Acad. Sci. U. S. 45, 952-9(1959) July.

Counting in liquid scintillators was found to be a quick and suitable method for the estimation of the activity of solutions of radioactive bicarbonate, benzoic acid, and sucrose in the presence of algal suspensions. The results were found reproducible for several dilutions. The counting efficiency was 80% for benzoic acid and sucrose. The activity of samples kept at −15°C did not change over a brief period of several hours. The method was applied to a search for the presence of unstably bound carbon dioxide in photosynthetic products. Results are tabulated. (C.H.)

17731

FAILURE OF CELL-FREE SPLEEN EXTRACTS TO PROTECT IRRADIATED ANIMALS. Fred Miya, Bert D. Thorpe, and Stanley Marcus (Utah Coll. of Medicine, Salt Lake City). Proc. Soc. Exptl. Biol. Med. 101, 433-5(1959) July.

Postradiation administration of cell-free mouse splenic extract to whole-body x-irradiated mice and guinea pigs did not result in protection against postradiation death. The treated animals died at an accelerated rate when compared to the controls. (auth)

17732

THE BEHAVIOR OF THE ALKALINE PHOSPHOMONOESTERASE ACTIVITY IN THE SPLEEN OF RATS RECEIVING A LETHAL DOSE OF WHOLE-BODY X RADIATION AND PROTECTED AND NON-PROTECTED WITH CYSTEAMINE. P. Bronzetti, A. Santoro, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 215-31 (1958) July-Sept. (In Italian)

The behavior of the phosphomonoesterase activity in the spleen of rats radiated with a mortal dose, protected and non-protected by cysteamine, was studied by Gomori's method. The radiated animals presented a considerable reduction of the enzyme activity where it is usually present and an intense reactivity of the perifollicolar zones which are usually not reactive. The radiated animals that had been previously treated with cysteamine presented the peculiar histochemical modifications induced by this drug on the spleen. (auth)

17733

PARTICULAR REACTIVITY OF THE PERIFOLLICULAR MANTLE OF THE SPLEEN OF RATS IN RELATION TO THE ACTION OF CYSTEAMINE AND IONIZATION RADIATION. P. Bronzetti, G. Pizzigalli, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 232-50 (1958) July-Sept. (In Italian)

The behavior of the perifollicular mantle of rat spleen was studied with respect to the administration of cysteamine (10 mg/100 gm of body weight) and ionizing radiation (800 r). It was determined that the cells of this zone which are extremely sensitive to different experimental conditions present characteristic reactions which differ from those of the Malpighian nodule and the red pulp. The data obtained are discussed, and hypotheses are suggested to interpret the phenomena. (auth)

17734

TOPOGRAPHIC AND QUANTITATIVE MODIFICATIONS OF THE PAS REACTIVITY INDUCED BY CYSTEAMINE IN THE SPLEEN STRUCTURE OF THE RAT. P. Bronzetti, G. Pizzigalli, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 251-64(1958) July-Sept. (In Italian)

The topographic and quantitative modifications of PAS reactivity induced by cysteamine in the spleen structures of rats were studied. It was observed that cysteamine may determine a very intense reaction to the PAS at the reticular adventitia of the blood capillaries of the splenic nodules and of the venous sinuses of the red pulp, as well as of the endothelial cells of the capillaries of the splenic nodules and of the cells of the reticulum of the red pulp. No reactivity was observed in the cells of the perifollicolar zone. (auth)

17735

HISTOCHEMICAL STUDY ON THE GLYCOGEN AND CLYCOPROTEIDS IN THE SPLEEN OF RATS WHOLE-BODY IRRADIATED WITH A FATAL DOSE, PROTECTED AND NON-PROTECTED WITH CYSTEAMINE. P. Bronzetti, G. Pizzigalli, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 265-79(1958) July-Sept. (In Italian)

The modifications of the glycogen content in the cells of the spleen were studied in whole-body irradiated rats (800 r), some protected by cysteamine and some unprotected. The variations in the reactivity to the PAS method of the reticular stroma of the capillaries of the splenic nodules and of the venous sinuses of the pulp were also investigated. A hypothesis is advanced to explain the modifications noted. (tr-auth)

17736

TOPOGRAPHIC AND QUANTITATIVE MODIFICATIONS OF THE GIROUD-LEBLOND-SOSA REACTIONS BY THE HISTOCHEMICAL DETERMINATION OF THE ASCORBIC ACID IN THE ADRENALS OF THE RAT AFTER TREATMENT WITH CYSTEAMINE. P. Bronzetti, G. Pizzagalli, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 280-96(1958) July-Sept. (In Italian)

The topographic and quantitative variations of ascorbic acid in the adrenals of rats treated with a single dose of cysteamine (10 mg/100 g of body weight) were

studied histochemically. It was shown that this drug, while causing a decrease and a modification of the reaction of the cortex, especially in the internal zona fasciculata and in the zona reticularis, causes, after 1 to 2 hours, an increase in the reaction in the medulla. After 24 hours there is a clear tendency towards normalization. (auth)

17737

QUANTITATIVE AND TOPOGRAPHIC MODIFICATIONS IN THE GIROUD-LEBLOND-SOSA REACTION BY HISTOCHEMICAL DETERMINATION OF THE ASCORBIC ACID IN THE ADRENALS OF THE WHOLE-BODY X-IRRADIATED RAT, PROTECTED AND NON-PROTECTED WITH CYSTEAMINE. P. Bronzetti, G. Pizzigalli, and C. Viviani (Università, Messina, Italy and Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 297-314(1958) July-Sept. (In Italian)

The behavior of the Giroud-Leblond-Sosa reaction in the adrenal gland of the whole-body x-irradiated (800 r) rat protected and unprotected with cysteamine was examined. It was shown that in the non-protected animal the reaction is almost completely absent at the 2nd and 96th hour after radiation. In the protected animal, instead, no fall is evidenced at the 96th hour, and after 168 hours the reaction has all the characteristics of the controls. (auth)

17738

COMBINED EFFECTS OF COLD AND X RAYS ON FISH. Ch. M. Gros, R. Keiling, J. Bloch, and J. P. Villain (Université, Strasbourg). Radiobiol. Latina 1, 361-75 (1958) Oct.-Dec. (In Italian)

In poikilothermal animals (Carassius carassius) the influence of the x-ray dosage on the survival after total irradiation at 18° has been studied. It is proven that low temperature has a protective effect against ionizing radiations and conversely that radiations give a protection against cold. (auth)

17739

OSMOTIC RESISTANCE OF LEUCOCYTES AND RADIOINDUCED LEUKOPENIA. Ugo Nuvolone and Giovanni Pisani (Ospedale Maggiore, Novara, Italy). Radiobiol. Latina 1, 386-91(1958) Oct.-Dec. (In Italian)

The variations of the number of leucocytes and the osmotic resistance of leucocytes in a group of rabbits treated with 500 r whole-body irradiation were studied. On the basis of the experimental results leucopenia after irradiation not only depends on the injury of medullar matrices, but also on peripherical cytolysis. The reduction of the number of leucocytes during the first hours after irradiation seems to be due, for the most part, to the cytolysis of circulating elements. (auth)

17740

MOLECULAR STRUCTURAL FACTORS IN COMPETITIVE INHIBITION OF SUGAR TRANSPORT. Paul G. LeFevre (Brookhaven National Lab., Upton, N. Y.). Science 130, 104-5(1959) July 10.

The high potency of phloretin as a competitive inhibitor of the human red cell's monosaccharide transport system is not shared by any of several molecular fragments of phloretin, but is duplicated in certain artificial estrogens resembling phloretin in respect to the spacing between terminal phenolic—OH groups. Related molecules which are slightly less extendible are comparatively inactive. (auth)

17741

RADIOCARBON FROM NUCLEAR TESTS. Wallace S. Broecker (Columbia Univ., New York) and Alan Walton (National Physical Lab., Teddington, Eng.). Science 130, 309-14(1959) Aug. 7.

As a result of the generation of neutrons in nuclear tests and their subsequent reaction with nitrogen in the atmosphere, considerable man-made C^{14} has been added to the earth's dynamic carbon reservoir. On the basis of the measured neutron yield per unit energy release and on the assumption that about two-thirds of the C^{14} produced falls back as calcium carbonate, Libby has estimated that 10×10^{27} atoms of C^{14} have been introduced into the atmosphere as CO_2. Rafter and Fergusson have shown that the C^{14} concentration in Southern Hemisphere tropospheric CO_2 has been increasing 2.1 percent per year since 1955. For the Northern Hemisphere, de Vries has suggested an increase of 4.3 percent between 1953 and 1957. The results of Munnich and Vogel point to an increase of about 3.2 percent per year for central Europe and 2 percent per year in South Africa over the period from 1954 to 1957. Considerable interest has been aroused in the possible genetic effects of this increase in the C^{14} concentration. Recent data related to this increase are presented together with a brief discussion of the probable distribution of bomb C^{14} within the dynamic carbon reservoir. (auth)

17742

BOMB CARBON-14 IN HUMAN BEINGS. Wallace S. Broecker, Arthur Schulert, and Edwin A. Olson (Columbia Univ., New York). Science 130, 331-2 (1959) Aug. 7.

The concentration of bomb-produced radiocarbon in human beings will lag behind the rising concentration in average atmospheric CO_2. Measurements on human materials suggest a lag of about 1 year for both breath CO_2 and blood, with the suggestion of a somewhat higher value for lung tissue. These results are in reasonable agreement with predictions based on independent evidence. (auth)

17743

RADIATION PROTECTIVE EFFECTS OF COLD IN FISH. Charles-Marie Gros, Roger Keiling, and Jacques Bloch (Faculté de Medecine, Strasbourg). Strahlentherapie 109, 241-5(1959) June-July. (In German)

Experiments with fish, Carassius Carassius L, irradiated at various temperatures indicate that a lower temperature increases the number of surviving fish. Data on the survival of fish irradiated at 3°C indicate that irradiation gives protection against cold. The LD_{50} at 18°C was determined to be 1800 r. (C.H.)

17744

THE QUESTION OF ORGAN BURDEN AND THE AVERAGE DOSE IN VARIOUS RADIATION QUANTITIES. Robert Bauer, Gerhard Breitling, and Karl Peters (Universität, Tübingen, Ger.). Strahlentherapie 109, 246-50(1959) June-July. (In German)

Problems related to determinations of superficial and depth doses of radiation are discussed. Data are tabulated from measurements made at various energies on mice, rats, guinea pigs, rabbits, and dogs. Glass phantoms are pictured which were prepared to check the measurements on rats and mice. (C.H.)

17745

THE INFLUENCE OF X-RAY WHOLE-BODY IRRADIATION ON THE ACTIVITY OF LACTIC ACID DEHYDROGENASE, GLUTAMIC OXALOACETIC TRANS-

AMINASE, AND GLUTAMIC PYRUVIC TRANSAMINASE IN THE BLOOD SERUM OF RATS. Helmut Oswald, Paul Georg Günther, and Werner Lorenz (Universität, Mainz). Strahlentherapie 109, 331-42(1959) June-July. (In German)

A single dose of 1000 r whole-body irradiation of rats did not change significantly the serum activity of lactic acid-dehydrogenase (MDH), glutamic oxaloacetic transaminase (GOT), and glutamic pyruvic transaminase (GPT). Whole-body irradiation of 1000 r on 10 consecutive days caused a significant decrease of the serum activity of MDH and serum GOT within 3 hours to 5 days following the last irradiation. There was no change of the activity of serum GPT. (C.H.)

17746

NEW POSSIBILITIES IN THE STUDY ON CLINICAL RADIATION EFFECTS. Josef Becker, Hans Ebner, and Karl-Heinz Kärcher (Universität, Heidelberg, Ger.). Strahlentherapie 109, 357-73(1959) June-July. (In German)

A survey of cytologic-cytochemical, biochemical, and histologic-histochemical diagnostic procedures is given. Their importance for the diagnosis of tumor diseases is discussed. In addition the possible follow-up of therapy during irradiation using these methods is pointed out. These methods, up to now used in basic medical research, form the basis of clinical radiation pathology, which should be one of the diagnostic tools of a radiotherapeutic hospital. (auth)

17747

THE VARYING INFLUENCES ON THE MUTABILITY OF MATURE AND IMMATURE GERM CELLS BY IRRADIATION IN N_2, O_2, AND CO ATMOSPHERES. Hedi Fritz-Niggli (Kantonsspitals, Zurich). Strahlentherapie 109, 402-11(1959) June-July. (In German)

The rate of mutations of dominant and recessive lethal factors and translocations in Drosophila depends on the stage of development of the germ cells irradiated in air. The scale of sensibility is the same for all types of mutations, beginning at the most sensitive stage: spermatocytes, spermatides, mature sperms, spermatogonia. Irradiation in pure N_2 and CO atmosphere decreases the rate of mutations. The protection effect of CO is less than the effect of N_2. The protection effect depends on the stage of development of the irradiated germ cell. Mature sperms respond little to protection factors. Their rate of mutations is increased by irradiation in pure O_2 atmosphere. The rate of mutations of irradiated spermatides and spermatocytes can be decreased considerably by irradiation in pure N_2. Spermatogonia are indifferent to irradiation in N_2 atmosphere. The possibility exists that an increased proportion of O_2 of spermatides and spermatocytes, as compared to mature sperms, may explain their sensibility to milieu factors. (auth)

17748

SOME PHYSICAL CHEMICAL CONSIDERATIONS ON THE ELIMINATION ON RADIOACTIVE METALS BY CHELATING AGENTS. Hans Jörg Heller and Alexander Catsch (Reaktorstation, Karlsruhe, Ger.). Strahlentherapie 109, 464-82(1959) June-July. (In German)

A simple semiquantitative picture is given describing the elimination of radioactive metals by low molecular weight chelating agents. Known mechanisms of biological differentiation have been taken into account but no complex-forming processes specific to the living organism have been considered. The experimental facts known today can be explained satisfactorily by the effects of equilibrium complexes only. (auth)

17749

INVESTIGATIONS ON THE CALCIUM METABOLISM IN THE EPIPHYSIS AND METAPHYSIS AFTER LOCAL X RADIATION. Jaromir Kolar and Arnost Babicky (Karls-Universität, Prague). Strahlentherapie 109, 483-8(1959) June-July. (In German)

The contents of calcium of the proximal epiphysis and metaphysis of the tibia of white rats following local irradiation by 3 different doses was studied by means of Ca^{45}. The maximum contents of the isotope was the same in all animals, which excludes a local accumulation in the irradiated area. When the contents of Ca^{45} became lower again a difference between the irradiated and unirradiated bones was observed. The contents of Ca^{45} decreased less the greater the dose of radiation and the bone damage were. No further active calcium uptake was observed. In the skeleton no evidence of a metabolic calcium reaction following irradiation was noted. (auth)

17750

THE EFFECT OF PROPERIDIN INACTIVATION ON THE RADIATION SYNDROME. Zoltán Zsebök (Medizinischen Universität, Budapest). Strahlentherapie 109, 523-32(1959) June-July. (In German)

Bacteriemia due to the radiation syndrome is caused by multiple factors. Among the immunization substances of the organism, properidin has an immunolytic, effect and is of great importance. It is a component of the complement C3. In special cases properidin can be inactivated by Zymosan, a polysaccharide in the wall of yeast cells. The effect of Zymosan was studied in animals following an irradiation of 720 to 800 r. A reactive increase of the white blood cells was found following the irradiation in the quantitative blood count. The properidin level of the surviving animals shows no significant difference at the 7th day. In the qualitative blood study a characteristical Zymosan reaction was observed. The neutralization of properidin tried by means of Zymosan has no effect on the mortality of the animals, as it was expected. (auth)

17751

THE EFFECT OF PENETRATING RADIATION ON DEVELOPMENT OF THE FOETUS IN EXPERIMENTAL CONDITIONS. S. L. Petrosyan and Z. F. Lopatnikova (Scientific Research Inst. of Roentgenology and Radiology). Vestnik Rentgenol. i Radiol. 34, No. 2, 38-42 (1959) Mar.-Apr. (In Russian)

The effect of radiation energy on development of the fetus was studied after general single irradiation of animals at various periods of pregnancy. Mature primipara white rats served as experimental animals. Investigations were carried out in 2 series of experiments. The results of investigations demonstrated that irradiation of rats during the first half of pregnancy (on the 8th–9th day) by the dose of 500 r brought about the death of embryos in the early stages of their development. Retardation of weight, changes in the fur and curvature of the spine were noted in the rats which were born. Irradiation during the second half of pregnancy in the same conditions causes development of acute radiation sickness in the newborns with the death rate of 92%. (auth)

17752

THE CLINICAL PICTURE OF RADIATION INJURIES OF THE BONES IN X-RAY THERAPY. Yaromir

Kolarzh and Radko Vrabetz (Karlov Univ., Prague). Vestnik Rentgenol. i Radiol. 34, No. 2, 43-7(1959) Mar.-Apr. (In Russian)

Roentgenological signs of various degrees of radiation injuries of the bones are described in 125 patients. These injuries were observed after irradiating the patients with malignant and benign tumors of different localization. Cases with rare changes of the bones are described. (auth)

17753

A COMPLEX METHOD OF TREATING RADIATION INJURIES OF THE SKIN. N. S. Kazantseva (I. M. Sechenov Order of Lenin Medical Inst., Moscow). Vestnik Rentgenol. i Radiol. 34, No. 2, 47-51(1959) Mar.-Apr. (In Russian)

Complex treatment of radiation injuries was carried out in 100 patients. The first stage included antibiotics administration coupled with the treatment intended for the general improvement of the patients' condition. Local application of Hippophea rhamnoides L. oil and covering of the ulcer with fibrin membrane were employed in the second stage to accelerate the granulation of the ulcer. The third stage consists of tissue therapy with novocaine block and epidermis Thiersch graft to stimulate the process of scarification. (auth)

17754

THE CLINICAL COURSE OF JAW WOUNDS IN ACUTE RADIATION INJURY. V. S. Dmitrieva (Central Inst. and Central Inst. of Traumatology and Orthopedics, Moscow). Vestnik Rentgenol. i Radiol. 34, No. 2, 52-6(1959) Mar.-Apr. (In Russian)

Observation of 400 x irradiated rabbits (in doses of 200, 400, and 600 r) with simultaneously inflicted injuries of soft tissues of the jaw demonstrated these irradiation doses to cause radiation sickness (mild, moderate, or severe). In acute radiation sickness the presence of the above wound aggravates the course of the disease. Healing of the wounds depends on the acuteness of the radiation injury. Experiments demonstrated the treatment of jaw wounds to be possible by various surgical methods (plastic surgery by means of the local tissues, free skin graft with formation of Filatov's tubed pedicle), if they are associated with the injury caused by ionizing radiation. (auth)

17755

PHASE DIAGRAM OF INDIUM–CADMIUM. Theo Heumann and Bruno Predel (Universität, Münster, Ger.). Z. Metallk. 50, 309-14(1959) June. (In German)

The indium–cadmium system was investigated by thermal, microscopic, dilatometric, and x-ray analysis, and a new phase diagram was established. A peritectic reaction was found, which leads to the $InCd_3$ phase. The solubility of cadmium in indium and the transformation of the tetragonal face-centered indium lattice into a cubic face-centered lattice between 4 and 5 at. % Cd were determined. (auth)

17756

NAKOPLENIYE RADIOAKTIVNYKH ELEMENTOV V ORGANIZME I IKH VYVEDENIYE. (Accumulation of Radioactive Elements in the Body and Their Excretion.) Vera Sergeyevna Balabukha and Gerts Yefimovich Fradkin. Moscow, Medgiz, 1958. 182p.

A book on radiobiology, intended for biologists and doctors, is presented. The first part of the book reviews the general rules governing the behavior and excretion of radioisotopes of the alkaline earths, rare earths, and heavy elements. In the second part, body accumulation of strontium, yttrium, and plutonium is considered. Detailed information and data evaulations on the behavior of these elements are given. (TCO-J.S.R.)

17757

PROGRESS IN NUCLEAR ENERGY. SERIES VI. BIOLOGICAL SCIENCES. VOLUME 2. Edited Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy, Geneva, 1958. J. G. Bugher, J. Coursaget, and J. F. Loutit, eds. New York, Pergamon Press, 1959. 441p. $15.00.

Thirty-seven selected papers in the field of biology are included which were presented to the Second International Conference on the Peaceful Uses of Atomic Energy, 1958. The items were selected as being representative of local interest in some parts of the world, of general interest at the present time, or of permanent historical value. Topics covered include radioinduced mutations, the metabolic response to radiation in the primate, aging effects of ionizing radiations, studies on erythropoiesis, radioinduced neoplasma, antibody formation in irradiated animals, the mechanisms of the effect of radiation on heredity and the problem of radiosensitivity, and mechanisms involved in biological effects of radiation. A complete subject index is included. (C.H.)

CHEMISTRY

General

17758 AAEC/E-24

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

CONSTANT CURRENT SOURCE FOR AUTOMATIC COULOMETRIC TITRATIONS. A. R. Palmer and A. W. Pryor. Mar. 1958. 10p.

A simple but versatile constant current source for automatic coulometric titrations is described. The unit is suitable for use with a commercial automatic pH titrimeter and will accommodate wide variations of main voltage and load resistance. Coulometric titrations may be carried out "fast" or "slow" with a choice of four current ranges (2 to 37 ma) for titrations up to or near the end point. A slow "1 ma" range is available for approaching the end point and the titration of microgram amounts of material. The automatic pH titrimeter provides for automatic change from fast to slow generation of the reagent and for stopping the titration at the selected end point. The utility of the equipment was demonstrated by the estimation of chromium with electrogenerated ferrous iron. The unit should be suitable for many other coulometric titrations. (auth)

17759 AECD-4286

New Brunswick Lab., AEC, N. J.

SOLVENT EXTRACTION CONCENTRATION OF CERTAIN RARE EARTHS IN YTTRIUM. A. R. Eberle and M. W. Lerner. Oct. 1957. Decl. July 24, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

A procedure is given for the concentration of gadolinium, dysprosium, and samarium in yttrium oxide by extraction of the thiocyanates with tributyl phosphate. Concentration of these elements up to 80-fold was obtained. Results are given on the effects of ammonium thiocyanate and tributyl phosphate concentrations, as well as pH, temperature, and sample size on the sepa-

ration. Analyses of standard yttrium oxide samples after concentration of these rare earths are in good agreement with results obtained by direct spectrographic analyses. (auth)

17760 AECU-4234
Anderson Physical Lab., Champaign, Ill.
PROGRESS REPORT [FOR] APRIL 1959. Technical Report No. 7. 21p. Contract AT(11-1)-544. $4.80(ph), $2.70(mf) OTS.

The purification of KCl by recrystallization, complexing agents, ion exchange, distillation, and chromatography is reported. A program to develop analytical procedures for the qualitative determination of salts is presented. The second run of the controlled atmosphere crystal grower is discussed. (For preceding period see AECU-4016.) (W.L.H.)

17761 AECU-4268
Monsanto Chemical Co., Everett, Mass.
ORGANIC COOLANT RECLAMATION. Quarterly Progress Report No. 2 [for] March 15, 1959—June 15, 1959. R. J. Wineman, B. J. Gudzinowicz, D. V. Lopiekes, D. A. Scola, and C. I. Tewksbury. July 15, 1959. 48p. Contract AT(11-1)-705. $7.80(ph), $3.30(mf) OTS.

In the second quarter of research on organic coolant reclamation, several methods are being studied simultaneously using model systems. Four catalysts were found to have activity in the vapor phase hydrocracking of model polyphenyls. All of these are dual-function catalysts. Practical conditions of relatively high yields and conversions per pass into desired products have not yet been attained. The chemistry of partial reduction of the lower members of the polyphenyl series in the liquid phase has been examined. A tentative conclusion requiring confirmation is that m-terphenyl at low percentage (<15%) partial reductions undergoes appreciable selective reduction of the central ring. Examination of the model redistribution reaction of benzene and m-terphenyl has not yet been sufficiently definitive to show whether or not this is a suitable method for reclamation. A number of specialized analytical methods, based on vapor phase chromatography and infrared spectroscopy, have been developed. (auth)

17762 AERE-AM-8
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN HEAVY WATER. R. J. Webb. Apr. 1959. 8p. $0.25(BIS).

A concentrate of the heavy water is evaporated on to silver electrodes and the spectrum excited in the condensed spark discharge. A medium quartz spectrograph is used to record the resulting spectra on Ilford long range spectrum plates, which are evaluated by visual comparison with standard plates. The method is suitable for the control analysis of heavy water requiring the determination of trace impurities in the range 0.01 to 1 ppm. It is semi-quantitative and determinations can be made to within a factor of 0.7 to 1.5. (auth)

17763 AERE-AM-10
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF TUNGSTEN IN BERYLLIUM METAL. E. Booth and A. Parker. Apr. 1959. 4p. $0.16(BIS).

Tungsten is converted to the dithiol complex and extracted into amyl acetate. The absorbency of the extract is measured at 640 mμ on a spectrophotometer, or alternatively on a Spekker absorptiometer using Ilford Filters No. 608. The method covers the range 5 to 200 ppm of tungsten. The error except in the lowest part of the range should not exceed 5%. (auth)

17764 AERE-AM-13
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF TUNGSTEN IN ZIRCALOY 2. E. Booth. Apr. 1959. 4p. $0.16(BIS).

Tungsten is converted to the dithiol complex and extracted into amyl acetate. The absorbency of the extract is measured at 640 mμ on a spectrophotometer, or alternatively on a Spekker absorptiometer using Ilford Filters No. 608. The method covers the range 2 to 100 ppm tungsten. The error except in the lowest part of the range should not exceed 5%. (auth)

17765 AERE-AM-15
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE SPECTROGRAPHIC DETERMINATION OF STRONTIUM IN THE ASH OF BONE, MILK AND VEGETATION. M. S. W. Webb. May 1959. 9p. $0.25(BIS).

Bone ash or calcium strontium oxalate fractions precipitated from the ash of milk or vegetation are diluted with graphite and copper sulfate and pelleted. Pellets are burned in graphite cups with anodic excitation at 7 amp dc. A Hilger 3-meter or a Hilger large automatic spectrograph may be used to record the spectra. The range covered is from 50 ppm to 350 ppm of strontium in the bone ash or oxalate fraction. The coefficient of variation at the 100 ppm level is 3% for the mean of four exposures. (auth)

17766 AERE-AM-16
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF COMBINED OXYGEN IN BERYLLIUM METAL. C. G. Wallace. Apr. 1959. 9p. $0.35(BIS).

The metal is dissolved in a copper sulfate—mercuric chloride solution buffered at pH 4. The oxide is extracted as the fluoride complex, converted to hydroxide, and determined volumetrically according to the reaction: $Be(OH)_2 + 4F^- \rightarrow [BeF_4]^= + 2(OH)^-$. The procedure is applicable to oxide contents in the range 0.01 to 5% as BeO. The coefficient of variation in the range 0.1 to 2% is about 15% for powders and between 5 and 10% for other forms of metal. (auth)

17767 AERE-AM-17
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF MANGANESE IN BERYLLIUM METAL. J. Walkden. May 1959. 5p. $0.16 (BIS).

The sample is dissolved in 50% sulfuric acid and after adding silver nitrate and nitric acid the manganese is oxidized to permanganate by potassium periodate. The manganese is determined absorptiometrically. The method is suitable for manganese contents up to 660 ppm. (auth)

17768 AERE-AM-18

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF CHROMIUM IN BERYLLIUM METAL. J. Walkden. May 1959. 6p. $0.16 (BIS).

The sample is dissolved and after oxidation with potassium permanganate the chromium is determined absorptiometrically after reaction with diphenyl carbazide. The method is suitable for the determination of chromium contents from 5 to 200 ppm. (auth)

17769 AERE-AM-22

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE DETERMINATION OF NICKEL IN BERYLLIUM METAL. J. Walkden. May 1959. 6p. $0.16(BIS).

The nickel dimethylglyoxime complex is extracted from the sample by chloroform, and after back extraction into dilute hydrochloric acid the nickel is estimated absorptiometrically as the oxidized dimethylglyoxime complex. The method is suitable for nickel contents up to 200 ppm. (auth)

17770 AERE-AM-29

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE VOLUMETRIC DETERMINATION OF BERYLLIUM IN BERYL ORE. C. G. Wallace. May 1959. 6p. $0.25(BIS).

The ore is decomposed by fusion with excess alkali metal carbonate and the silica removed with hydrofluoric acid. Alumina is removed by a second fusion with alkali carbonate and the remaining oxides are ignited. Beryllium oxide is selectively reacted with alkali metal fluoride and determined by titration of the liberated alkali. The procedure is particularly suitable for high-grade ores where oxides of Ca, Mg, Fe, Ti, and Zn are not present together in amount exceeding the beryllium oxide content. Scandium oxide causes appreciable interference and should not be present in excess of 3% of the BeO content. At the level of 10% BeO the error is not likely to exceed 0.1% and the results have a coefficient of variation of 1%. (auth)

17771 AERE-C/R-2698

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE THERMAL STABILITY OF PLUTONYL NITRATE SOLUTIONS WITH REFERENCE TO THEIR USE IN A HOMOGENEOUS AQUEOUS REACTOR. D. E. Glanville. May 1959. 16p. $0.35(BIS).

The effect of high temperature (150 to 300°C) on the stability of Pu(VI) solutions in dilute nitric acid is reported. The plutonium concentrations were 7 to 10 g/l, the nitric acid concentrations 0.01 M to 1.0 M, and the containing materials glass and silica (for experiments without an oxygen over-pressure) and stainless steel (for experiments with 500 psi of oxygen). It is concluded that the use of stainless steel and an oxygen over-pressure increase the apparent solution stability, probably due to the oxidizing influence of either the oxygen or the corrosion products of the stainless steel, but that complete stability of a 7 g/l solution over an observation period of three days at 265°C can only be attained by the use of a nitric acid concentration in the range 0.1 to 0.5 M. This is usually considered to be rather high for a reactor system. (auth)

17772 AERE-HP/R-627(Amended)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE ANALYSIS OF BIOLOGICAL SAMPLES FOR POLONIUM. J. Rundo. Dec. 1950. Decl. July 1958. 13p. $0.35(BIS).

A method has been developed for the estimation of very small amounts of polonium in urine and other biological samples. Suitable procedures for the initial preparation and oxidation of the materials followed by extraction, deposition, and counting of the polonium are described. The method involves the removal of organic material by wet oxidation and co-precipitation of the polonium with tellurium. The polonium is then separated from the tellurium and deposited on one side of a silver foil for counting. The over-all recovery has been tested with spiked samples and is about 85 per cent. The analytical procedure is given in detail in an appendix. (auth)

17773 AERE-R-2878

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH COBALT AND CERIUM. G. Phillips and E. Foster. May 1959. 15p. $0.35 (BIS).

A procedure is described for the determination of plutonium, cobalt, and cerium in their ternary alloys. The plutonium is separated from an acid solution of the alloy by absorption as the nitrate complex on anion exchange resin. The cobalt and cerium are recovered in the column effluent and determined without further separation. Cobalt is determined absorptiometrically with nitroso-R-salt and cerium by titration with potassium permanganate in pyrophosphate solution to a photometric end point. The plutonium is recovered from the column by elution with hydroxylamine hydrochloride and determined absorptiometrically using the Pu(III) color. (auth)

17774 AFOSR-TN-59-613

Johns Hopkins Univ., Baltimore.

MECHANISMS OF ISOTOPIC EXCHANGES IN THE BORON HYDRIDES. Technical Note No. 11. Walter S. Koski. June 1959. 20p. Contract AF18(600)-1526. (AD-217400).

The exchange of deuterium and B^{10} between diborane and several of the more common boron hydrides was studied with the expectation that a knowledge of the exchange mechanism will give a better insight into the nature of the intermediate fragments that play an important role in the chemistry of these compounds. Evidence has been accumulated for at least three mechanisms by which isotopic exchange proceeds in the boron hydrides. In the diborane self-exchange the reaction appears to involve borane as an entity and the ratio of deuterium rate to boron rate is three. In the $B_2D_6-B_5H_9$ exchange the rate-determining step is the reaction of borane with the terminal hydrogens of pentaborane. The bridge hydrogens are not involved at all. A similar situation exists in the diborane-decaborane exchange. In the $B_2D_6-B_5H_{11}$ reaction the fraction-order kinetics indicate that the B_5H_{11} is fragmenting. All of the borons and all of the hydrogens in both molecules are participating in the exchange. Only one rate of exchange has been

observed but there is experimental evidence that exchange can proceed by an intramolecular mechanism. In the case of the $B_2D_6-B_4H_{10}$ reaction one has at least two mechanisms of isotopic exchange and evidence has been obtained for an exchange that proceeds by an intramolecular mechanism. The intramolecular process is an indication of the lability of the hydrogens and the borons in some of the less stable boron hydrides. (auth)

17775 APEX-485

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

LITERATURE SURVEY ON CALCIUM HYDRIDE. Eugene P. Kilb. July 1959. 58p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.75(OTS).

A compilation of almost every article available from 1891 to 1955 on calcium hydride or its systems is presented. Included are data on the history and physical, chemical, and the nuclear- and electron-configuration properties. 133 references. (auth)

17776 APEX-506

General Electric Co Aircraft Nuclear Propulsion Dept., Cincinnati.

A NEW STANDARDIZATION TECHNIQUE FOR X-RAY ABSORPTION MEASUREMENTS. J. O. Hibbits, S. S. Cooper, and M. R. Menke. Aug. 1959. 8p. Contract AF33(600)-38062 and AT(11-1)-171. $0.50(OTS).

Tests of previously suggested methods of determining uranium in solution by x-ray absorption indicated that daily calibration of the photometer is necessary because of changes in response. It was found that by using machined aluminum plates as standards rather than uranium solutions, the time necessary for daily calibration can be reduced to about 15 minutes. The method was found to have a limit of error of ±0.25% at the 95% confidence level for a single determination of uranium in a solution equivalent to about 30 milligrams uranium dioxide per gram of solution. It was found difficult to obtain cells matched for x-ray absorption work, a point that has been insufficiently stressed in the past. (auth)

17777 ARF-6039-3

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

INVESTIGATION OF GRAPHITE BODIES. Progress Report No. 3 for the Period March 1, 1959 to May 31, 1959. S. W. Bradstreet. Includes Appendices: I. SYNTHETIC BINDERS FOR CARBON AND GRAPHITE. Charles H. Riesz and Sherman Susman. II. HIGH TEMPERATURE PHYSICAL PROPERTIES OF MOLDED GRAPHITES. H. H. Lund and S. A. Bortz. June 10, 1959. 78p. Contract AF33(616)-6143. $12.30(ph), $4.50(mf) OTS.

Research described in Appendix I conducted under Contracts AF33(616)-5158; AF33(616)-6143; and AT(33-3)-4.

Experimental data regarding the behavior and properties of a wide variety of binders are summarized. It is concluded that the high coke density of furfuryl alcohol (with toluene p-sulfonic acid), coal tar pitch, phenol formaldehyde, and phenol benzaldehyde are worthy of further investigation. A particular problem with the synthetic thermosetting resins is their narrow temperature range of gas evolution in dense structures. Continued work on fabrication techniques demonstrated the need for precise temperature control for molding pitch-bonded specimens, a vacuum enclosure for the mold, and a holding period during molding sufficient to insure temperature equilibrium. Combining these techniques limits variations in green density to less than ±0.01 gm/cc when 10% or more of thermax is substituted for coke flour. The influence of thermax additions to pitch-bonded coke is summarized and correlated with packing theory. Nearly a thousand specimens of pitch- or furfuryl alcohol-bonded coke and coke-thermax have been made and carbonized for graphitization in a single batch. Specimens include 1 × 2 × ¼-inches, 1 × 1 × 4-inches, and 2.3 × 2.3-inches of thickness up to nearly two inches. Difficulties in obtaining sound structure have not been serious except with high-density furfuryl alcohol-bonded coke thermax or the largest specimens. Graphitized densities in excess of 1.8 gm/cc were achieved. Techniques for measuring flexural and tensile strength and flexural dynamic modulus of small specimens at room temperature to the creep threshold were developed and will be applied to experimental graphites. These measurements were applied to a molded commercial graphite (Speer No. 3499) and are appended in summary form. Differential thermograms for the most promising binders were obtained in several atmospheres at increased and reduced pressure. The reactions believed to influence the thermograms are confirmed by shrinkage domains (determined by dilatometry) at the same temperature levels. (auth)

17778 CCC-454-TR-306

Callery Chemical Co., Penna.

PHYSICAL PROPERTIES OF BORON TRIBROMIDE. W. F. Barber, C. F. Boynton, and P. E. Gallagher—S. L. Harvey, ed. Mar. 25, 1959. 18p. Project ZIP. Contract NOa(s) 58-454-d.

The triple point of a sample of 99.96 mole % boron tribromide was found to be −46.482°C. Over the temperature range −20 to 90°C, the density values were found to fit the equation $d_{(g/ml)} = 2.6954 - [2.962 \times 10^{-3} t_{(°C)}]$. Over the temperature range 0 to 90°C, the viscosity values fit the equation $\log \eta_{(millipoises)} = 331/t - 0.250$. Over the temperature range 22 to 84°C, the surface tension values fit the equation $\gamma_{(dynes/cm)} = 31.9 - 0.128\ t_{(°C)}$. Over the temperature range 0 to 90°C, the vapor pressure values fit the equation $\log P_{(mm)} = 6.9795 - 1311/[t_{(°C)} + 230]$. (auth)

17779 CCC-454-TR-307

Midwest Research Inst., Kansas City, Mo.

VAPOR PRESSURE AND CRITICAL CONSTANTS OF METHYL BORATE. R. L. Hughes, A. R. Pittaway, and F. T. King—S. L. Harvey, ed. Mar. 27, 1959. 16p. For Callery Chemical Co. Project ZIP. Contract NOa(s) 58-454-d.

The vapor pressure versus temperature for methyl borate was measured from the normal boiling point to the critical point. The critical temperature was observed to be 229 ± 0.5°C, and the critical pressure 502 psia (34 atmospheres). Log $P_{(mm.\ Hg)}$ vs. reciprocal temperature fits the equation: $\log P_{(mm.\ Hg)} = 7.6949 - 1648.8/T°C$. The compressibility data of methyl borate were calculated from a modification of the generalized Beattie-Bridgeman equation of state. (auth)

17780 CCC-454-TR-312

Callery Chemical Co., Penna.

THE PREPARATION, UNIT CELLS, AND SPACE GROUPS OF TWO ETHERATES OF SODIUM TRIDECAHYDRODECABORATE(1-). H. G. Norment, Jr.—S. L. Harvey, ed. May 25, 1959. 8p. Project ZIP. Contract NOa(s) 58-454-d.

The mono-ethyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13} \cdot (C_2H_5)_2O$, and the bis-methyl etherate of sodium tridecahydrodecaborate(1-), $NaB_{10}H_{13} \cdot 2\,(CH_3)_2O$, have been prepared. Unit cell dimensions and space groups were determined for both materials by single-crystal x-ray diffraction techniques. (auth)

17781 CEA-835

France. Commissariat à l'Énergie Atomique, Paris.

DOSAGE DE L'OXYDE DE SODIUM DANS LE SODIUM. THE LA MÉTHODE AU MERCURE: SON UTILISATION DANS LE CAS DE TRES FAIBLES TENEURS. (Determination of Sodium Oxide in Sodium. The Mercury Method: Its Utilization in the Case of Very Low Concentrations.) L. Champeix, R. Derras, and J. Duflo. 1958. 10p.

The precision of the mercury method for the determination of sodium oxide is evaluated for microanalytic applications. The apparatus used for the analysis, the procedure, and the calibration are described in detail. Flame spectroscopy was used for the determination of the sodium hydroxide formed. The errors introduced by the presence of sodium and calcium chlorides are discussed. The results obtained are examined with respect to their reproducibility. The method can be used for the determination of oxygen in sodium at values less than 10 ppm with satisfactory precision if care is taken in the procedure. (tr-auth)

17782 CF-58-7-8

Oak Ridge National Lab., Tenn.

ARGON AS A PROTECTIVE ATMOSPHERE FOR MOLTEN SALTS. L. A. Mann. July 1, 1958. 6p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

In reactors employing circulating molten salt fuels and having most of the Kr and Xe gases stripped from the fuel into the off-gas, argon may reasonably be used as the blanket (and stripping) gas. In such cases, the activity of Kr and Xe and their descendents so far exceeds that of Ar^{41} and K^{41} produced that no additional provision is needed for shielding. The amounts of Rb, Sr, Cs, and Ba are so much greater than that of K that no additional provision against chemical attack is needed. (auth)

17783 CF-58-12-40

Oak Ridge National Lab., Tenn.

CRYSTAL STRUCTURES OF SOME COMPOUNDS OF UF_4 AND ThF_4 WITH ALKALI FLUORIDES. R. E. Thoma. Dec. 11, 1958. 5p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

X-ray-diffraction data and optical properties are reported for the compounds $\delta-2NaF \cdot UF_4$, $\delta-2NaF \cdot ThF_4$, $\delta-2RbF \cdot UF_4$, $\delta-2RbF \cdot ThF_4$, $\delta-NaF \cdot KF \cdot UF_4$, and $\delta-NaF \cdot RbF \cdot UF_4$. Additional properties are given for the compounds $7KF \cdot 6ThF_4$, and $7RbF \cdot 6ThF_4$. (auth)

17784 HW-57431

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PHASE RELATIONSHIPS IN MIXTURES OF THE SIMPLE POLYPHENYLS AND CONDENSED RING AROMATICS—A SURVEY OF ORGANIC REACTOR COOLANT MIXTURES. V. H. Troutner. Aug. 27, 1958. 76p. Contract W-31-109-Eng-52. $2.25(OTS).

The phase relationships for all mixtures of biphenyl, naphthalene, phenanthrene, ortho-terphenyl, meta-terphenyl, and monoisopropylbiphenyl were examined to determine what mixture constitutes and optimum organic coolant. The ten binary and ten ternary melting point diagrams for the five unsubstituted compounds under consideration were determined experimentally. The vapor composition diagrams were also calculated for all of these mixtures. Some data were also obtained for the four and five component systems. Although some of the purely aromatic mixtures were liquid at 25°C or less, none of them satisfied the optimum coolant criteria with regard to the composition of the vapor phase. A ternary mixture of monoisopropylbiphenyl, ortho-terphenyl, and meta-terphenyl was found to satisfy all the criteria for an optimum organic coolant. A quaternary optimum mixture contains 14 wt. % monoisopropybiphenyl, 54 wt. % o-terphenyl, 15.5 wt. % m-terphenyl, and 16.5 wt. % phenanthrene. (W.L.H.)

17785 IDO-14469

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ZIRCONIUM FLUORIDE PHASE STUDIES. I. A PRELIMINARY INVESTIGATION OF SOLID PHASES. A. G. Chapman and R. A. Woodriff. Jan. 15, 1959. 17p. Contract AT(10-1)-205. $0.50(OTS).

Solid phases in the zirconium-nitric acid-hydrofluoric acid system were identified by chemical and x-ray diffraction methods. Five different compounds were crystallized at various temperatures and fluoride concentrations from fluoride or fluoborate solutions. These include the mono- and trihydrates of zirconium tetrafluoride, plus three hydrolysis products which possess a fluoride-to-zirconium ratio of approximately three, yet produce different x-ray patterns. The trifluorides crystallize from solutions of low fluoride-to-zirconium ratio at temperatures of below 90°, 65 to 100°, and above above 95°C, respectively. Solubilities of these basic trifluorides were measured at 25°C in 1, 6, and 16M nitric acid. (auth)

17786 IGO-AM/S-20

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF COMBINED NITROGEN IN TITANIUM METALS. May 10, 1956. 8p.

The metal is dissolved in hot 6 N sulfuric acid and hydrogen peroxide. Ammonia separated by distillation from alkaline solution is determined absorptiometrically using either sodium phenate/sodium hypochlorite for samples containing 5 to 90 ppm combined nitrogen or Nessler's reagent for samples containing 90 ppm to 1.0% combined nitrogen. The method has been used for pure powder, sponge, or wrought titanium metal containing 5 ppm to 1.0% combined nitrogen. At the 10 and 90 ppm levels results show a negative bias of about 5% with a coefficient of variation of ± 4%. At the 500 ppm and 0.75% levels results are quantitative with a coefficient of variation of about ± 3%. (auth)

17787 IGO-AM/S-129

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE GRAVIMETRIC DETERMINATION OF SULPHATE IN URANIUM CONCENTRATES. Feb. 27, 1959. 4p.

Ten grams of sample are dissolved in hydrochloric and nitric acids. The solution is diluted and filtered. The filtrate is made up to standard volume and a suitable aliquot withdrawn which is neutralized with ammonia solution and then made slightly acid with hy-

drochloric acid. This solution is boiled and barium chloride solution added. The barium sulfate is filtered off and finally ignited and weighed. (auth)

17788 IGO-AM/S-130

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF COPPER IN BERYLLIUM METAL. Mar. 3, 1959. 5p.

The beryllium metal is dissolved in sulfuric acid, and the copper is determined absorptiometrically as its diethyl dithiocarbamate complex. The method is suitable for the determination of copper in beryllium metal over the range 40 ppm to 0.8%. At the 100 μg copper level, 200 μg of iron, 100 μg of nickel, and 100 μg manganese in the aliquot taken will not give any significant interference. The precision (3 × sigma) is equivalent to ±9 μg copper at the 120 μg level. (auth)

17789 IGO-AM/S-131

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF SILICON IN BERYLLIUM. 1959. 6p.

The beryllium metal is dissolved in electrolytic, silicon-free sodium hydroxide, and the solution is acidified using sulfuric acid. The silico-molybdic acid formed by the addition of ammonium molybdate is reduced, using stannous chloride, to molybdenum blue and measured absorptiometrically. The method is suitable for the analysis of beryllium metal containing silicon within the range 25 ppm to 1%. (auth)

17790 IGO-AM/S-134

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF CHROMIUM IN BERYLLIUM METAL. Mar. 3, 1959. 6p.

The beryllium is dissolved in sulfuric acid, and the chromium is oxidized to the chromic state and determined absorptiometrically as its diphenyl carbazide complex. The method is suitable for the determination of chromium within the range 25 ppm to 0.15%. The precision (3 × sigma) is equivalent to ± 3 μg chromium at the 50 μg level. (auth)

17791 IGO-AM/S-150

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF FREE CARBON IN BERYLLIUM METAL (BY IGNITION WITH A GASOMETRIC FINISH). Mar. 3, 1959. 10p. $0.25(BIS).

The sample is dissolved in sulfuric acid. The solution is filtered and the residue is washed, dried, and ignited in a stream of oxygen. The carbon dioxide produced is measured by means of a gasometric finish. The method is applicable to beryllium flake, powder, swarf, and ingot. Provided that the sample is homogeneous, the precision obtainable is of the order of ±10% but ±30 ppm at low levels (< 300 ppm). The lower limit of detection is approximately 30 ppm. (auth)

17792 IGO-AM/S-151

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF COMBINED CARBON IN BERYLLIUM METAL (BY IGNITION WITH A GASOMETRIC FINISH). Mar. 3, 1959. 12p. $0.25(BIS).

The sample is dissolved in sulfuric acid, and the evolved gases (methane and hydrogen) are passed over copper oxide at 850°C. The water produced is removed, and the carbon dioxide is measured by means of a gasometric finish. The method is applicable to beryllium flake, powder, swarf, and ingot. Provided that the sample is homogeneous, the precision is of the order of ±10%, but ±30 ppm at low levels (< 330 ppm). The lower limit of detection is approximately 30 ppm. (auth)

17793 IGO-AM/S-160

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF IRON IN URANIUM–MOLYBDENUM ALLOYS. Mar. 3, 1959. 5p.

The alloy is dissolved in nitric and hydrochloric acids. Uranium is complexed with ammonium tartrate and the iron reduced with hydroxylamine hydrochloride. The pH of the solution is adjusted to between 6.0 and 6.5, and the iron is then determined absorptiometrically as the ferrous ortho-phenanthroline complex. The method is applicable to alloys containing up to 20% molybdenum, with an iron content not exceeding 500 μg in the final solution. (auth)

17794 IGO-AM/S-190

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC AND VOLUMETRIC DETERMINATIONS OF COMBINED NITROGEN IN BERYLLIUM METAL (MODIFIED ALLEN METHOD). Mar. 3, 1959. 9p.

The metal is dissolved in dilute sulfuric acid. The ammonia, separated by distillation from alkaline solution, is determined absorptiometrically, using sodium phenate/sodium hypochlorite reagent for samples containing 10 to 4000 ppm combined nitrogen. Higher nitrogen contents are determined by absorbing the ammonia in standard acid and back titrating with standard alkali. The method has been used for pure metal flake containing 10 ppm to 2% combined nitrogen. (auth)

17795 IGR-TN/CA-277

United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.

CHEMICAL AND X-RAY CRYSTALLOGRAPHIC STUDIES ON URANYL FLUORIDE. L. H. Brooks, E. V. Garner, and E. Whitehead. Feb. 9, 1956. 27p.

A study was made by chemical and x-ray crystallographic methods of anhydrous uranyl fluoride and its compounds with water and hydrofluoric acid. The anhydrous material was synthesized by four different methods. All the products had the same x-ray pattern. The hydrates and hydrofluorinated hydrates from one of the preparations was studied. Four compounds, each characterized by distinct x-ray patterns were encountered. Each of these appeared to exist over a range of composition. The reaction between excess hex gas and water vapor was studied in the laboratory. The primary product has the empirical composition of uranyl fluoride monohydrate. The primary product of hex/water vapor interaction from the diffusion plant was studied by x-ray diffraction. It has a diffraction pattern different from any of the laboratory preparations. On hydration

it transforms to one or other of the four synthetic hydrates or hydrofluorinated hydrates. This transformation is reversible. Both the laboratory and plant products have been studied under the polarizing microscope. Attempts to obtain "fiber" photographs from oriented assemblages of crystallites have met with some success and indicate a line of approach for unit cell and structure determinations. The inter-relationships between the phases are discussed, and methods are suggested for a further elucidation of the system. (auth)

17796 IS-3

Ames Lab., Ames, Iowa.

EXTRACTION EQUIPMENT AND SAMPLING TECHNIQUE USED IN SEMI-CONTINUOUS SILVER–URANIUM EXTRACTION STUDIES. Edwin H. Olson, Morton Smutz, and Clayton W. Watson. July 1959. 24p. Contract W-7405-eng-82. $0.75(OTS).

Small scale, semi-continuous extraction runs for extracting irradiated neodymium from a molten uranium–neodymium alloy using droplets of molten silver at 1250 and 1290°C are described. Two different silver drop sizes and flow rates were used. The graphite extractor, silver metering device, and the extract sampling equipment are described. The experimental extraction data obtained are presented. These data were correlated reasonably well with equations developed for multistage batch extractions. The actual neodymium concentrations obtained were compared with equilibrium data to determine extraction efficiencies for the various runs. Extraction efficiencies of 15 to 35% were found, with higher efficiencies resulting when large sized drops were used. In these runs, a considerable amount of neodymium was apparently removed by carbide formation with the container wall prior to the extraction with silver. (auth)

17797 JPL-PR-30-9

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

ANALYSIS OF A FUEL-AIR COMBUSTION MIXTURE BY INFRARED SPECTROSCOPY. Progress Report. J. S. Whittick and R. F. Muraca. May 21, 1959. 10p. Contract NASw-6.

A method of analysis is described for the products resulting from the incomplete combustion of a mixture of liquid hydrocarbon fuel and excess air. Gas sample generally is found to consist of air, unburned fuel, carbon dioxide, carbon monoxide, ethylene, and acetylene. These are first determined simultaneously by infrared absorptiometry. Then the sample is passed through a furnace at 800°C in order to complete the combustion, and the increment of carbon dioxide is determined by infrared absorptiometry. The oxygen-nitrogen ratio of the sample is found by an Orsat gas analysis. (auth)

17798 KAPL-M-JR-12

Knolls Atomic Power Lab., Schenectady, N. Y.

THE CHEMICAL DETERMINATION OF BORON IN BORON CARBIDE–ZIRCONIUM, CLAD WITH ZIRCALOY. J. Rynasiewicz and V. F. Consalvo. May 5, 1959. 23p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

A rapid dissolution chemical method for the determination of boron in Zircaloy-clad boron carbide–zirconium is described. The sample is dissolved in a mixture of hydrofluoric plus hydrochloric acids contained in a platinum dish which is cooled in a dry-ice bed. Approximately 96 to 99% of the total boron remains undissolved. This is filtered off, ashed, fused with sodium carbonate, and the boron is determined according to mannitol titration method. The acid-soluble boron is determined by a modified mannitol titration after separating the zirconium and other interfering cations with barium carbonate. The acid-insoluble and acid-soluble boron are added to give the total boron in the sample. The accuracy and precision of this analysis were checked on synthetic mixtures of "standard" boron carbide plus zirconium. At the 2% boron carbide (1.59% B) level or higher, the method was accurate to at least 1.15 relative per cent. The precision (95% confidence level) was ± 0.27 and ± 0.95 relative per cent based on 8 measurements or a single measurement, respectively. "Standardization" of the boron carbide sample was performed by analyzing for boron, carbon, and impurities. A mass balance of 100.22 ± 0.69% was obtained and the boron value was considered accurate within the precision of the analytical method. (auth)

17799 NAA-SR-3154

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HIGH TEMPERATURE GAS CHROMATOGRAPHY OF AROMATIC HYDROCARBONS; INSTRUMENT DESIGN AND EXPLORATORY STUDIES AT TEMPERATURES UP TO 430°C. Robert A. Baxter and Robert T. Keen. June 1, 1959. 30p. Contract AT-11-1-GEN-8. $1.00 (OTS).

A gas chromatograph capable of successful operation at temperatures up to at least 430°C has been fabricated and evaluated. The important features and operating characteristics of the instrument are described. Several immobile phases have been tested for partitioning quality and high temperature stability. The best material found was a polyphenyl type tar with an average molecular weight of 2100. The high temperature technique has been used for both qualitative and quantitative analysis of irradiated polyphenyl reactor coolant-moderator materials. At 430°C it has provided the means for analyzing mixtures of compounds having five to six aromatic rings. (auth)

17800 NP-7735

Iowa State Coll., Ames.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED MATERIALS. Progress Report for April 1, 1959 to June 30, 1959. Henry Gilman, Bernard J. Gaj, Oren L. Marrs, and William J. Trepka. 20p. Contract AF33 (616)-6127.

Organosilylmetallic compounds have shown a wide versatility in reaction, particularly for the preparation of so-called custom-made molecules. In some of these reactions involving oxygen or oxygen-containing molecules it is necessary to account for secondary transformations. Partly for this reason an examination has been made of the oxygen-oxidation of a typical organosilylmetallic compound; namely, triphenylsilyllithium. These reactions were carried out largely in tetrahydrofuran. Where comparisons can be made there appear to be no striking differences between tetrahydrofuran and tetrahydropyran. It should be stated, however, that although triphenylsilyllithium is formed at a slower rate in tetrahydropyran it appears to be more stable in this solvent than in tetrahydrofuran. The chief products formed by the oxygen-oxidation of triphenylsilyllithium are triphenylsilanol, triphenylsilane, and hexaphenyldi-

silane. The ratio of these products varies with the temperature. For example, the highest yield of triphenylsilanol was obtained at the lowest temperatures: the yield was 60.3% at −25°C; 47% at 0°C; and 32.6% at 25°C. The yield of triphenylsilanol when oxidation was effected at 0°C in tetrahydropyran was 51.9%. In the discussion of the oxygen-oxidation of triphenylsilyllithium some possible modes of reaction are considered. Although triphenylsilyllithium was used as a model in these experiments, it is probable on the basis of other studies that comparable results may be expected with two other organosilylmetallic compounds which have been used extensively: namely, methyldiphenylsilyllithium and dimethylphenylsilyllithium. It is possible that trialkylsilylmetallic compounds may undergo some variations. The report made at this time on some terphenyl-silicon compounds is essentially an extension of earlier work. Several investigations in different laboratories have demonstrated that a phenyl group attached to silicon contributes appreciably to thermal stability. Some nuclear substituents add to this effect, particularly chlorine. Formally, the biphenylyl group is a substituted phenyl group. Furthermore, the resonance characteristics of a biphenylyl group might also be expected to effect radiation-resistance. Additionally, earlier studies indicated that ortho-biphenylyl groups attached to silicon had a marked effect on keeping such compounds in a glass-like or liquid state. For these several reasons we have extended the introduction of phenyl and of biphenylyl groups to some terphenylyl groups. The two considered at this time are the m-terphenylyl group and the p-terphenylyl group. Two interesting intermediates which were prepared are benzyl-m-terphenyl-4′-ylsilane and phenyl-m-terphenyl-4′-ylsilane. These R_2SiH_2 types should provide ready access to a variety of R_3SiH and R_4Si compounds by procedures which have already been described. In the discussion of the terphenylyl-silicon studies, a number of comparisons have been drawn concerning melting point and structure. In this connection it is noteworthy that n-dodecyltri-p-terphenyl-4-ylsilane has a lower melting point than the parent hydrocarbon, p-terphenyl. Also, when each of the two p-hydrogen atoms in p-terphenyl have been replaced by trimethylsilyl groups, the melting point is only about two degrees above that of the parent p-terphenyl. (For preceding period see NP-7372.) (auth)

17801 NP-7744

Shell Chemical Corp. Industrial Chemicals Div., New York.

CONCENTRATED HYDROGEN PEROXIDE. SUMMARY OF RESEARCH DATA ON SAFETY LIMITATIONS. [1959]. 78p. (SC-59-44).

Increasing interest in the use and handling of concentrated hydrogen peroxide necessitates a clear understanding of hydrogen peroxide's properties and reactions in order to avoid potentially dangerous situations. The most serious potential hazard is the possibility of explosion or detonation. The liquid phase system containing only hydrogen peroxide and water appears safe from explosion at room temperature up to about 96% hydrogen peroxide. From 96 to 100% hydrogen peroxide, it is possible to obtain high order propagating detonations. The vapor phase of the hydrogen peroxide-water system is explosive when it contains 26%m (40%w) hydrogen peroxide at atmospheric pressure. It is well known that certain mixtures of hydrogen peroxide and organic compounds can explode with considerable violence. The available data on this subject have been collected, organized, and correlated. In addition, some new experimental data have been obtained. A correlation method has been developed to describe the explosion limits of all systems investigated to date. The use of this method allows estimates of the potential explosion hazards of new systems to be made. Detonation data, primarily from German research performed during World War II, have been correlated and the result used to interpret data which show clearly the relationship of the limits of high order detonation to the explosion limits determined by simple impact or blasting cap tests. Effects of charge diameter, strength of initiation, confinement, etc., have been taken into account. It appears unlikely that a high order detonation is possible outside the explosion limits previously reported for various systems. (auth)

17802 NP-7745

Monsanto Chemical Co., Everett, Mass.

RESEARCH ON SYNTHESIS OF 1000°F. STABLE BASE FLUIDS. Quarterly Report No. 5 [for] February 1, 1959—April 30, 1959. James W. Dale, Iral B. Johns, and Elizabeth A. McElhill. May 11, 1959. 23p. Project No. 2002. Contract AF33(616)-5553.

Perfluorocyclobutane containing about 10% perfluoroisobutylene appeared to be stable at 1240°F when tested in a monel apparatus at atmospheric pressure. Tests indicated that, among the aromatics, condensed aromatic compounds have the greatest stability and substituted naphthalenes and polyplenyls are slightly more stable than substituted quinolines. It appears that for polyaromatic compounds with an extrapolated boiling point near 1000°F, the highest stability which could be expected would be about 950°F. (W.L.H.)

17803 NP-7750

New York Univ., New York.

RESEARCH ON SOLID STATE RADIATION-INDUCED PHENOMENA. Interim Progress Report No. 5 for Month of April 1959. Hartmut Kallmann. June 1959. 20p. Contract DA-36-039-sc-75043.

Recent claims that the interaction leading to transfer of excitation energy from one molecule to another may be associated with a transition to the ground state without concomitant radiation are examined. Direct experimental evidence is presented which shows that such energy transfer interaction is not accompanied by special nonradiative transitions, and it is shown that this is to be expected on theoretical grounds. The anomalous behavior of the ZnCdS(Mn) phosphors under β excitation and infrared stimulation is reported. Stimulation data are available for the 0%, 10%, and 50% ZnCdS(Mn) phosphors. The 0% CdS phosphor was found to have a stimulation area 100 times larger than that of the respective deficiency areas, whereas for the 10% CdS phosphor it was only 20 times larger. Although the 50% CdS phosphor has a negligible stimulation area, the β rise curve taken after stimulation indicated that the phosphor was de-excited. Excitation with β and concomitant infrared radiation is reported along with the dependence on the intensity of fluorescence with the wavelength of the emitted light. Excitation with the 4360 A mercury line is also presented for the 40% CdS phosphor. It was found that under direct solute with uv fluoranthene in PMMA does not show the decrease of fluorescence with increasing concentration which was reported for other solutes. PS/9,10-dimethoxyanthracene, behaves as a normal PS scintillator. Naphthalene is effective as intermediate "solvent" with this solute. (auth)

17804 NP-7751
Stanford Research Inst., Menlo Park, Calif.
THERMOELECTRIC MATERIALS. Bimonthly Progress Report No. 1 for October 19, 1958 to February 1, 1959. J. W. Johnson. Feb. 10, 1959. 4p. SRI Project No. SU-2681. Contract NObs-77017.

A study to evaluate various materials, both as solids and liquids, for possible use as elements for thermoelectric generators is presented. The principal effort was devoted to the phthalocyanines. Initial measurements of the conductance of crystals were made. (W.L.H.)

17805 NP-7755
Montana State Coll., Bozeman.
THE ELECTRIC MOMENTS AND SOME OTHER PHYSICAL PROPERTIES OF $VOCl_3$, VCl_4 AND THE SIMPLE ALKYL ORTHOVANADATES (thesis). Frederick Cartan. June 1959. 129p.

$VOCl_3$, VCl_4, and several of the simple alkyl esters of orthovanadic acid have been prepared. Their densities, indices of refraction, and dielectric constants have been measured. The alkyl esters were found to be monomeric in benzene. Solution values for the electric moments of these compounds were measured. The solvent for the alkyl orthovanadates was benzene; for the halides it was carbon tetrachloride. The electric moments of all compounds, except VCl_4 and t-butyl orthovanadate have been calculated using the Onsager equation. The observed solution electric moments and the Onsager moments are (in debyes): vanadium oxytrichloride, 0.31, 0.39; vanadium tetrachloride, 0, --; ethyl orthovanadate, 1.18, 1.16; n-propyl orthovanadate, 1.15, 1.11; i-propyl orthovanadate, 1.23, 1.40; n-butyl orthovanadate, 1.13, 1.09; i-butyl orthovanadate, 1.10, 1.10; s-butyl orthovanadate, 1.01, 1.30; t-butyl orthovanadate, 1.16, --; t-amyl orthovanadate, 1.11, 1.22. These observed electric moments strongly indicate that the V–O bond moment is low. This can be explained by the assumption of pi bonding in this linkage. It is suggested that an equilibrium exists between the monomer and a polymer and that the color observed in several of the esters is due to the polymeric form. Infrared, near infrared, visible and n.m.r. proton spectra are presented. (auth)

17806 NP-7803
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
SPECTROGRAPHIC DETERMINATION OF CADMIUM IN URANIUM OXIDE BY FRACTIONAL PREDISTILLATION. Report No. 92/VIII. L. Pszonicki. June 1959. 15p.

A method was developed for determining cadmium in samples of nuclearly pure uranium. In order to separate the spectra of cadmium and of uranium and to enrich at the same time the samples, the method of fractional predistillation with carrier (AgCl) was applied. Used as carrier, silver chloride was found to be active during both excitation and distillation of the sample. Detection limit was 0.01 μg/g. (auth)

17807 NRL-5325
Naval Research Lab., Washington, D. C.
WETTING OF LOW-ENERGY SOLIDS BY AQUEOUS SOLUTIONS OF HIGHLY FLUORINATED ACIDS AND SALTS. Interim Report. Marianne K. Bernett and W. A. Zisman. Apr. 21, 1959. 15p. Project NR-472-000.

Wettability studies of aqueous solutions of several series of pure, highly fluorinated aliphatic acids and salts were carried out on two low-energy organic solids, polyethylene and Teflon. As anticipated, the fluorinated compounds were able to depress the surface tension of water below the critical surface tension (γ_c) of Teflon, and were therefore capable of completely wetting it. This is in contrast to the limitations of conventional wetting agents which are hydrocarbon derivatives. Whenever possible, wettability curves were obtained for each solid surface by plotting the cosine of the contact angle versus the surface tension of the solution. The value of γ_c, 19 dynes/cm, thus obtained for Teflon is in reasonable agreement with the value of 18 dynes/cm established from previous studies. With polyethylene a value of γ_c of 20 dynes/cm was obtained which is much lower than the established value of 31 dynes/cm. This led to experiments demonstrating that the phenomenon was caused by the adsorption of the fluorinated compounds on the polyethylene surface, thereby altering its wetting characteristics to those of a fluorinated surface. As expected from the difference in their surface energies, greater and more tenacious adsorption was observed on polyethylene than on Teflon. (auth)

17808 NYO-4755
New York Operations Office. Health and Safety Lab., AEC.
THE DETERMINATION OF THE URANIUM CONTENT OF THE NATIONAL BUREAU OF STANDARDS IRON AND STEEL CHEMICAL STANDARDS. George A. Welford and Doris Sutton. Feb. 7, 1957. 26p. $4.80 (ph), $2.70 (mf) OTS.

A procedure for the isolation of uranium from iron and steel matrices is outlined. This method is used to determine the uranium content of ten National Bureau of Standards Iron and Steel Chemical Standards. The uranium is absorbed from a one normal sulfuric acid solution of the iron or steel standard on to IRA-400 ($SO_4^=$), a strong base anion exchanger. The 0.05 normal hydrochloric acid is used to wash interfering cations from the resin bed. The uranium is eluted from the resin bed with 2.0 molar perchloric acid. Any residual iron, usually less than five milligrams, is removed from the uranium fraction by mercury cathode electrolysis or by cupferron extraction. The resulting solution is analyzed fluorophotometrically. The method shows a recovery of better than 90% when 0.5 to 5 micrograms of uranium are added to solutions containing five grams of iron and steels. (auth)

17809 ORNL-2620
Oak Ridge National Lab., Tenn.
THE DETERMINATION OF TRACE ELEMENTS IN WATER BY NEUTRON ACTIVATION ANALYSIS. R. L. Blanchard and G. W. Leddicotte. Aug. 11, 1959. 78p. Contract W-7405-eng-26. $2.25(OTS).

Neutron activation analysis was applied to seven water samples from selected geographical areas in the United States. The technique proved adequate for the identification and measurement of nineteen different elements ranging in concentrations from 0.00002 to 63.3 ppm. Irradiations were conducted in the Oak Ridge Graphite Reactor, gamma spectrometry serving as the principal tool for identification and measurement of specific induced radionuclides. The degree of chemical separation required for a given sample depended upon the element being determined and the variety of constituents present. It was possible to determine chlorine, sodium, and argon on the sample as irradiated. Most other elements required

separation. Ion exchange and precipitation were investigated, and the latter proved most generally satisfactory. General chemical separation was adequate for certain elements. Others required specific procedures. A summary of the elements identified, time of irradiation, and analytical procedure is given. From the results reported it is believed that neutron activation analysis can be a valuable tool for sanitary engineers and geochemists in water studies. The technique is specific in that each induced radionuclide decays with its own characteristic radiation and half life. It is sensitive in that concentrations as small as 10^{-11} gram of some elements can be determined with an accuracy of ± 5% or better. The study reported was limited to elements yielding radionuclides with half lives ranging from minutes to days. Location of counting equipment nearer irradiation facilities would permit determinations involving radionuclides of much shorter half lives, thus widening the range of elements suitable for analysis. (auth)

17810 ORNL-2678 (Suppl.)
Oak Ridge National Lab., Tenn.
TABLES OF ISOTOPE EFFECT FUNCTIONS FOR HOMOCOMPETITIVE FIRST-ORDER REACTIONS. SUPPLEMENT. M. H. Lietzke and Clair J. Collins. July 15, 1959. 10p. Contract W-7405-eng-26. $1.80 (ph), $1.80 (mf) OTS.

Supplementary data to ORNL-2678 are given, representing calculations of R for values of k*/k from 0.950 to 0.998 in increments of 0.002, and for values of f from zero to 0.5 in increments of 0.1. All symbols have the same meaning as defined in ORNL-2678. (W.D.M.)

17811 RDB(W)-5246
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
COMPLEXES OF PLUTONIUM (IV) WITH PHENYLARSONIC ACID DERIVATIVES. I. 1(o-ARSONOPHENYLAZO)-2-NAPHTHOL-3: 6-DISULPHONIC ACID (THORONOL). D. A. Charman and D. W. Ockenden. July 4, 1955. 29p. (ARDC/P-112).

Plutonium(IV) and thoronol form only one complex containing one atom of plutonium for one molecule of thoronol. This complex is only formed quantitatively and immediately over the pH range 0.95 to 1.35 in nitric acid, but once formed is comparatively stable over a much wider pH range. The complex forms a colloidal solution that is stabilized by the presence of excess thoronol. The stability constant of the complex was approximately determined and the molar absorbancy indices found for the complexes of thoronol with plutonium (III), (IV), and (VI). The behavior of UO_2^{2+}, Fe^{3+}, Cr^{3+}, Al^{3+}, and La^{3+} in the presence of thoronol was studied. In some cases the metal was found to compete with plutonium for the reagent. As a result of this investigation an absorptiometric method for the determination of plutonium is proposed. (auth)

17812 SCS-M-39A
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF TITANIUM IN URANIUM METAL, AMMONIUM DIURANATE, PURE STRIPPED EXTRACTION LIQUOR AND URANOUS FLUORIDE. Oct. 12, 1954. 6p.

Titanium is separated as the cup ferride and determined absorptiometrically with thymol. The method is suitable for a concentration range of 2 to 20 ppm titanium. The range may be extended by suitable aliquoting of the original solutions. The precision is ± 25% (3 × sigma) at the level of 20 ppm. (auth)

17813 SCS-M-41
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF SILICON IN CRUDE URANIUM PEROXIDE. June 22, 1949. 5p.

Silicon is extracted by alkali fusion and converted to silico-molybdic acid. The silico-molybdic acid is reduced to molybdenum blue, and the absorbence of this solution is determined using the Spekker absorptiometer. (auth)

17814 SCS-M-47
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF COBALT IN CRUDE URANIUM PEROXIDE, URANIC LIQUORS, MOTHER LIQUORS AND URANIUM METAL. July 15, 1949. 4p.

The sample, containing a slight excess of nitric acid, is treated with sodium citrate, acidified with acetic acid, and the cobalt complexed with potassium ethyl xanthate. The complex is extracted into chloroform, which is then removed by evaporation and after oxidation of any residual organic matter with nitric acid, the cobalt is dissolved in hydrochloric acid. Sodium acetate solution and the nitroso-R salt reagent are added and the solution boiled with nitric acid to destroy any other metal complexes present. After boiling for an optimum time the solution is cooled, diluted to a known volume and its absorbency determined. (auth)

17815 SCS-M-56
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF ZINC IN URANIUM METAL, AMMONIUM DIURANATE, PURE STRIPPED EXTRACTION LIQUOR AND URANOUS FLUORIDE. Mar. 26, 1952. 6p.

After removal of nickel as the dimethyl glyoxime complex, zinc is extracted as the dithizonate. Co-extracted metals and excess dithizone are removed with sodium sulfide and the zinc determined absorptiometrically. The following levels of impurities can be tolerated (ppm): Fe, 1000; Ni, 500; Cu, 30; Co, 10; Si, 500; Pb, 10; Mn, 20; Al, 500; and Cr, 200. Precision is ± 13% (3× sigma) at 20 to 30 ppm zinc. (auth)

17816 SCS-M-103
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE VOLUMETRIC DETERMINATION OF FLUORINE IN URANIUM METAL. Mar. 2, 1954. 7p.

The uranium metal is dissolved in nitric acid. The fluorine is steam distilled from sulfuric acid at 150°C, the distillate collected and titrated with thorium nitrate using chrome azurol S as indicator. The method is suitable for a concentration range of from 5 to 50 μg of fluorine and has a precision of ± 25% (3 × sigma) at 0 to 20 ppm fluoride. (auth)

17817 SCS-M-130
Gt. Brit. Springfields Works, Springfields, Lancs, England.
THE DETERMINATION OF CHROMIUM IN URANOUS FLUORIDE. Apr. 7, 1954. 5p.

Fluorine is removed and the residue fused with fusion

mixture to obtain the chromium in soluble form. After leaching the melt with acid, the chromium is oxidized to dichromate and determined absorptiometrically as its diphenyl carbazide complex. The method is suitable for a concentration range of 0 to 200 ppm chromium. (auth)

17818 SCS-M-278

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF LITHIUM AND MAGNESIUM IN LITHIUM–MAGNESIUM ALLOYS. Feb. 15, 1955. 5p.

The sample is dissolved in acid. The magnesium is precipitated from an aliquot of the solution as oxinate which is titrated bromometrically. The lithium is determined in the filtrate from the magnesium determination by direct evaporation to dryness and weighing as lithium sulfate. The method is applicable to mixtures of pure lithium and magnesium in a ratio of approximately 1 to 10. (auth)

17819 SCS-M-360

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN URANIUM POWDER USING THE LUNDEGARDH TECHNIQUE. Sept. 8, 1953. 6p.

The metal powder is converted to uranyl nitrate hexahydrate and dissolved in water. The solution is examined by the Lundegardh flame technique and the spectrogram evaluated microphotometrically. The method is suitable for samples containing from 50 to 2000 ppm of calcium with a precision of ± 10%. (auth)

17820 SCS-M-362

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF SODIUM IN URANIUM AND URANIUM COMPOUNDS. Sept. 11, 1953. 6p.

The sample is converted to uranyl nitrate hexahydrate and dissolved in water. The solution is then examined by the Lundegardh flame technique and the spectrograms evaluated microphotometrically. The method is suitable for samples containing from 20 to 10,000 ppm of sodium with a precision of ± 10%. (auth)

17821 SCS-M-400

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF URANIUM IN GRASS. Apr. 22, 1955. 5p.

A suitable weight of the grass is wet oxidized by means of nitric acid (sp.gr. 1.42) and sulfuric acid (sp.gr. 1.84). The silica present is removed by treating with 40% hydrofluoric acid and the uranium present coprecipitated along with added iron by addition of ammonia solution. The precipitate is re-dissolved in nitric acid (1 + 7) and taken to low bulk. The acid solution is then transferred to an ether extraction apparatus and the aqueous solution extracted with ether for two hours. The ether is evaporated off, the solution evaporated to dryness, re-dissolved in nitric acid, and extracted again with ether for 1½ hours. The ether is then evaporated off and the solution heated to dryness with nitric and perchloric acids. The residue is then taken up in sulfuric acid (1 + 17) neutralized with sodium hydroxide and then poured into a mixed solution of sodium hydroxide and sodium pyrophosphate. The uranium is then determined absorptiometrically with hydrogen peroxide. (auth)

17822 SCS-M-411

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF MOLYBDENUM IN NIOBIUM–MOLYBDENUM ALLOYS. Sept. 9, 1955. 4p.

The sample is fused with sodium hydroxide, the melt is leached with water, and the solution is filtered. Any niobium remaining in the filtrate is precipitated, and molybdenum is precipitated as lead molybdate from this second filtrate. The method is based on investigations with alloys containing 3 to 8% molybdenum. (auth)

17823 SCS-M-414

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF FLUORIDE IN URANIUM TETRAFLUORIDE. Sept. 19, 1955. 6p.

Fluoride is distilled as hydrofluosilicic acid from a sulfuric acid solution of the sample into a solution of sodium hydroxide. An aliquot of the distillate is titrated, in the presence of a buffer, with thorium nitrate solution using alizarin red S as indicator. (auth)

17824 SCS-R-4

Gt. Brit. Springfields Works, Springfields, Lancs, England.

AN INVESTIGATION INTO THE DETERMINATION OF TRACE QUANTITIES (0.3–0.5%) OF FREE NITRIC ACID IN URANYL NITRATE HEXAHYDRATE AND URANYL NITRATE LIQUORS. F. J. Armson, H. Mason, R. E. Cockaday, and R. E. Worthington. Aug. 4, 1949. 11p.

A method suitable for plant control was designed to determine (A) nitric acid in uranyl nitrate hexahydrate over the concentration range 0.3 to 0.5% w/w and (B) nitric acid in uranyl nitrate dissolver liquors over the range 0.1 to 5.0% w/v. With (A) direct determination of pH was found to be insufficiently sensitive but with both (A) and (B) satisfactory results could be obtained by potentiometric titration. The limitations of the methods should be clearly understood, and the method is not applicable to solutions outside the concentration ranges of HNO_3 and $UO_2(NO_3)_2$ specified. (auth)

17825 SCS-R-77

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE DETERMINATION OF RARE EARTHS IN URANIUM METAL. P. A. Serin and R. Franklin. May 31, 1949. 9p.

A method was developed for the chemical concentration of rare earths from uranium prior to their spectrographic estimation. The bulk of the uranium is removed by ether extraction of the uranyl nitrate hexahydrate. Concentration of the rare earths from the residue is carried out by a double oxalate precipitation on a calcium carrier followed by removal of the calcium and any other remaining impurities by a double hydroxide precipitation on spectrographically pure iron. (auth)

17826 SCS-R-123

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF IRON, COPPER AND MANGANESE IN URANIUM METAL.

A. B. Crowther, M. Bimson, H. T. Neville, and F. Warburton. Mar. 1, 1950. 14p.

Existing methods for the estimation of iron, copper, and manganese in uranium were examined and suggestions made for their improvement. No changes in the broad outline of the methods have been considered, but close examination of the existing procedures revealed serious flaws which might lead to erroneous results. These were inadequate control of the conditions for complete separation of the three elements and also the separation of copper from iron. In addition, the optimum conditions for the absorptiometric determination of iron and manganese were investigated. (auth)

17827 SCS-R-125

Gt. Brit. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF LITHIUM IN BARIUM CHLORIDE CONTAINING STRONTIUM. P. C. Palin. Feb. 28, 1950. 7p.

The determination of lithium in barium chloride is unsatisfactory in the presence of strontium. A new method of preparing a concentrate of lithium for spectrographic examination by the Lundegärdh technique is described. The bulk (95%) of the barium is first removed as sulfate, leaving all the lithium and strontium in solution; the remainder of the barium (5%) is then precipitated as sulfate in alcohol. All the strontium is co-precipitated with the barium, and the lithium is left free from strontium in solution. When small quantities of the order of 5 to 20 μg lithium were added to solutions of 5 g barium chloride (i.e., 1 to 4 ppm) satisfactory "recovery" was obtained. The new method has also the advantage that hydrochloric acid is eliminated from the concentrate before it is spectrographed, thus avoiding suppression of the lithium line 6707.8 A by hydrochloric acid. (auth)

17828 SCS-R-201

Gt. Brit. Springfields Works, Springfields, Lancs, England.

SPECTROGRAPHIC EXAMINATION OF SODIUM NITRITE FOR TRACE IMPURITIES. G. I. Goodfellow, S. Housley, A. P. Seyfang, T. H. Boyd, and M. Diggle. Feb. 20, 1952. 20p.

Development of methods for determining trace amounts of the lighter elements in sodium nitrite is described. Aluminum, beryllium, calcium, and magnesium are determined by the iron flux procedure after preliminary separation from sodium on a cation exchange column. Beryllium, scandium, and titanium are similarly determined after separation from sodium by co-precipitation with iron hydroxide. Lithium and potassium are determined by directly spectrographing a solution of the sodium nitrite by the Lundegardh procedure. Methods tried unsuccessfully were direct arcing of the solid sample, direct sparking of a solution of the sample, and concentration of impurities as their oxinates prior to determination by the iron flux procedure. (auth)

17829 SCS-R-236

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE CONVERSION OF URANYL NITRATE, AMMONIUM DIURANATE AND URANOUS FLUORIDE TO URANIUM HEXAFLUORIDE FOR ISOTOPIC MASS ABUNDANCE MEASUREMENTS BY THE MASS SPECTROMETER. D. Bevan and P. E. Pearson. Oct. 2, 1951. 9p.

Investigations are described which have been carried out on the conversion of uranyl nitrate, ammonium diuranate and uranous fluoride to the volatile hexafluoride for isotopic mass abundance measurements by the mass spectrometer. Uranous fluoride was fluorinated by treatment with condensed chlorine trifluoride in an enclosed system in the absence of air and moisture. Ammonium diuranate, and uranyl nitrate were fluorinated after conversion to uranoso -uranic oxide. Separation of excess chlorine trifluoride and various by-products from the prepared uranium hexafluoride was effected by fractionation involving the use of liquid air and solid carbon dioxide/trichlorethylene "cold traps." The pure uranium hexafluoride was collected in a pyrex glass "break seal" sample tube which was then sealed off. (auth)

17830 SCS-R-273

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF TRACE AMOUNTS OF LITHIUM IN URANIUM TETRAFLUORIDE. C. H. Fawcett and R. Franklin. Aug. 8, 1951. 4p.

The carrier distillation method of analysis of uranium and its compounds has been found satisfactory for the determination of lithium in uranium tetrafluoride. Known amounts of lithium have been added to samples of uranium tetrafluoride followed by conversion to the black oxide (U_3O_8). The oxide has been examined spectrographically by the above method and satisfactory recoveries of lithium have been obtained. (auth)

17831 SCS-R-282

Gt. Brit. Springfields Works, Springfields, Lancs, England.

DETERMINATION OF ZINC IN PURE URANIC MATERIALS. A. B. Crowther, F. Warburton, and M. Bracewell. Mar. 25, 1952. 7p.

Zinc may be determined in uranium and those intermediates occurring after the ether barrier by means of diphenylthiocarbazone (dithizone). Nickel is removed initially by chloroform extraction of the dimethylglyoxime complex, but other metals reacting with dithizone are co-extracted with the zinc and afterwards removed by shaking with sodium sulfide. Some indication of the tolerable level of other impurities is given. (auth)

17832 SCS-R-293

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF CALCIUM IN URANIUM POWDER USING THE LUNDEGARDH TECHNIQUE. R. Franklin and O. W. Smith. Mar. 23, 1953. 5p.

An investigation was carried out to extend the Lundegardh technique for the determination of alkali metals to the determination of calcium in uranium metal powder. A method was evolved by which calcium can be determined with a precision of approximately ± 10% with a lower limit of detection of 50 ppm. The uranium metal powder is dissolved in nitric acid and calcium determined directly on the solution without removal of the uranium. Owing to suppression of the spectrum by uranium, the standard solutions used for the calibration curve must contain the same concentration of uranium as the sample solutions. (auth)

17833 SCS-R-354

United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE SPECTROGRAPHIC DETERMINATION OF ALU-

MINIUM AND BERYLLIUM IN MAGNOX ALLOYS. A. L. Wilson, L. Lloyd, and J. McMaster. Jan. 31, 1955. 13p. (ARDC/P-55).

A method for the determination of aluminum and beryllium in Magnox alloy was developed. The sample is dissolved in HCl, and the solution analyzed by the porous cup technique. Spectra are recorded by means of a Hilger Large Glass/Quartz spectrograph, and the plates evaluated by intensity methods. The method has been standardized to cover the concentration ranges in the alloy of 2.5 to 0.25% aluminum and 0.06 to 0.006% beryllium, but the sensitivity may easily be improved considerably. The approximate coefficients of variation (calculated for single exposures) are 2% for aluminum at the 1.0% level and 3.5% for beryllium at the 0.03% level. The method is simple, precise, and rapid; it is estimated that one operator may conveniently determine aluminum and beryllium in twenty samples within nine to ten hours, the maximum error being not greater than ± 10%. Suggestions for future general investigation of the porous cup method are made. (auth)

17834 SCS-TN-30

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE REPRODUCIBILITY OF THE C.R.L. "SHORT COLUMN" METHOD FOR THE DETERMINATION OF "MIXED OXIDES" (Nb/Ta205) IN FERRONIOBIUM. J. A. Ryan and A. P. Seyfang. June 18, 1954. 3p.

Results indicate that the C.R.L. short method when applied to the analysis of ferroniobium is capable of giving satisfactory results for the Ta/Nb content both as regards precision and accuracy. (auth)

17835 SCS-TN-31

Gt. Brit. Springfields Works, Springfields, Lancs, England.

THE MOLECULAR ASSOCIATION OF HYDROGEN FLUORIDE. A SHORT REVIEW OF THE PUBLISHED LITERATURE. J. D. Rushmore. June 15, 1954. 4p.

A brief review is presented of the more important published literature on the molecular association of hydrogen fluoride. (18 references). (auth)

17836 UCRL-8803

California. Univ., Berkeley. Lawrence Radiation Lab.

THE CRYSTAL STRUCTURES OF SEVERAL cis-1,2-DIHALOBENZOCYCLOBUTENES (thesis). George Lind Hardgrove, Jr. June 22, 1959. 69p. Contract W-7405-eng-48. $2.00(OTS).

The crystal structures of the cis-1, 2-diiodo-, dibromo-, and dichloro- derivatives of benzocyclobutene have been determined by single-crystal x-ray-diffraction methods. The halogen-substituted double ring system shows a combination of resonance and steric strain effects on the bond distances and molecular configurations. $C_8H_6Br_2$ and $C_8H_6I_2$ are isomorphous, crystallizing in space group $Pna2_1$ with four molecules per unit cell. The structure of the dibromo- derivative has been determined by three-dimensional least-squares refinement with 613 independent reflections. The full-matrix least-squares refinement technique is compared to the diagonal approximation method. The four- and six-membered rings are nearly coplanar, sharing a bond shortened by ring strain. The other bond lengths are in agreement with values predicted for nonstrained systems. A similar arrangement was found to be consistent with the data for $C_8H_6I_2$. The crystal structure of $C_8H_6Cl_2$ has been determined at room temperature and at liquid nitrogen temperature by single-crystal x-ray-diffraction methods, including three-dimensional least-squares refinements. At both temperatures the crystals have essentially the same monoclinic structure in space group $P2_1/c$ with four molecules in the unit cell. The bond distances derived from the room-temperature determination differ from those found at low temperature in a manner attributable to anisotropic thermal motions. The low-temperature determination shows the side bonds of the four-membered ring shortened to 1.448 ± 0.010A, presumably because of cooperative resonance effects of the chlorine atoms and the phenyl ring. The two carbon atoms attached to the chlorine atoms are 1.562 ± 0.014A apart, with the steric strain effects predominating over resonance shortening. (auth)

17837 UR-551

Rochester, N. Y. Univ. Atomic Energy Project.

LEAD-HYDROXY APATITE INTERACTION. Hillel J. Gitelman and William F. Neuman. June 8, 1959. 25p. Contract W-7401-eng-49. $4.80(ph), $2.70(mf) OTS.

Because of the marked tendency of lead once absorbed to deposit in the skeleton, a series of experiments were performed on the interactions between aqueous lead solutions and crystals of synthetic hydroxy apatite, the prototype of bone mineral. This kind of system has been profitably employed to study a number of ions with respect to the mechanisms by which these substances selectively deposit in bone. For example, such commonly known bone seekers as Ra, Sr^{90}, and Ca^{45} have been shown to undergo ionic exchange with calcium ions at the crystal:solution interface. Lead does interact with the crystal:solution interface, but the mechanisms clearly are more complicated than the relatively simple ion exchange processes previously elucidated. Part of the fixation is extremely rapid followed by a relatively slow readjustment. Some speculation can be given, but further study of this interesting and perhaps fundamental phenomenon is urgently needed. (auth)

17838 USNRDL-TR-341

Naval Radiological Defense Lab., San Francisco.

QUANTITATIVE RADIOCHEMICAL ANALYSIS BY ION EXCHANGE. V. CALCIUM, STRONTIUM, AND BARIUM. L. Wish. July 10, 1959. 13p.

A procedure was developed for the separation of calcium, strontium, and barium from the rare earths and from each other. This is similar to the ion-exchange method of Baerg and Bartholomew which elutes cerium, lanthanum, strontium, and barium sequentially from a Dowex-50 X12, 87°C column using solutions of ammonium α-hydroxyisobutyrate. By lowering the cross-linkage of the resin to 8% and changing the concentration and pH, it was possible to accomplish the analytical separation at room temperature. Column runs with cerium-144, calcium-45, strontium-85, and barium-133 tracers showed that the recoveries were quantitative. No significant cross contamination could be detected by gamma-ray spectrometer measurements. The determination of barium and strontium was then included in the sequential radiochemical analytical scheme for mixed fission product and actinide elements. Rhodium and ruthenium radionuclides were found to be contaminants. These were eliminated by a pre-ion exchange ruthenium distillation and the adsorption of rhodium from 0.1 N hydrochloric acid on an anion exchange column. (auth)

17839 WADC-TR-53-426(Pt. 7)

Iowa State Coll., Ames.

ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH TEMPERATURE LUBRICANTS AND RELATED

MATERIALS. Period covered: December 1957 to November 1958. Henry Gilman, Bernard J. Gaj, Dan K. Aoki, M. V. George, Oren L. Marrs, William J. Trepka, and Ernest A. Zuech. Mar. 2, 1959. 111p. Project title: RUBBER, PLASTICS AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3510. (AD-215444).

Properties of organo-metallic and organo-metalloidal compounds are tabulated. These compounds were investigated in connection with studies of hydraulic fluids and lubricants. (J.R.D.)

17840 WADC-TR-58-495
Columbia Univ., New York.
GAS-LUBRICATED BEARINGS, A CRITICAL SURVEY. Gilbert F. Boeker, Dudley D. Fuller, and Carl F. Kayan. July 1958. 296p. Project 3066. Contract AF33(616)-5054. (AD-216356).

Part I summarizes the work on the hydrodynamic types of gas-lubricated thrust and journal bearings with their attendant problems such as self-excited shaft vibrations. In Part II, the literature on externally-pressurized bearings is critically reviewed. An effort has been made to present a broad picture of what is known in terms of analysis, design and performance for these bearings. Emphasis has been given to those areas where further information is definitely needed. Part III describes an electrical network useful in analyzing the pressure and flow relations within the various portions of the gas-bearing path. (auth)

17841 WADC-TR-59-64
National Bureau of Standards, Washington, D. C.
THERMAL DEGRADATION OF POLYMERS AT TEMPERATURES UP TO 850°C. Period covered: February 1, 1958 to January 31, 1959. Samuel L. Madorsky and Sidney Straus. Jan. 31, 1959. 27p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: NEW CHEMICALS AND METHODS. Contract AF33(616)-58-8. (AD-215852).

Work on thermal degradation of polymers has previously been carried out at temperatures up to about 500°C. In the present work the temperature has been extended to about 850°C. Polystyrene was pyrolyzed in a vacuum and also in helium at atmospheric pressure at 362 and 850°C. Analysis of the volatile products indicate that higher temperatures and higher pressures cause a greater fragmentation of the volatile products. Three polymers poly(vinylidene fluoride), polyacrylonitrile, and poly(vinylbenzene) and 4 thermoset plastics (Vibrin, epoxy, phenolico, and silicone) were pyrolyzed in a vacuum at temperatures from 350 to 800°C and the products analyzed in the mass spectrometer. In all cases stabilization occurred in terms of a nonvolatile residue. Measurements were also made on rates of thermal degradation in a vacuum of poly(vinylidene fluoride), polyacrylonitrile, and poly(trivinylbenzene). (auth)

17842 WADC-TR-59-147
Evans Research and Development Corp., New York.
DETERMINATION OF SURFACE FREE ENERGY OF METALS AND POLYMERS. James Haygood, Robert Ullman, and Seymour Z. Lewin. Apr. 1959. 86p. Project title: SURFACE AND INTERFACE PHENOMENA OF MATTER. Task title: RESEARCH IN PHYSICAL PROPERTIES OF FILMS AND SURFACES. Contract AF33(616)-3567. (AD-211923).

A new method for the determination of the surface free energy of solids has been developed. The method is based on Williamson's suggestion for the determination of the residual force after correcting for bulk forces in creep experiments. This correction for bulk forces is made by running two samples of different surface to volume ratios against one another differentially. A series of measurements has been made on aluminum, on nylon, and on gold. Each of these series has resulted in at least one surface energy value of the correct order of magnitude. The values are not yet, for various reasons, considered reliable. In further work, it is planned to increase the precision of individual measurements. When this has been accomplished, the results should be reliable within 0.1 gram/cm. A furnace has been constructed that will hold the temperature constant within 0.01°C up to 800°C (by present method of measurement). With present equipment, elongation measurements can be made within 2×10^{-3} cm, and differential elongation measurements to 6×10^{-5} cm can be made between two samples. The furnace will accommodate two 10-cm-long samples. One per cent elongation would be 10^{-1} cm which can be measured with a precision of 2%. A smaller elongation might be desirable for internal equilibrium and for shorter running time, but with the present equipment it is necessary to use an elongation of the order of 1%. Although reasonable values have been obtained for the surface tensions of aluminum, nylon, and gold, many unreasonable results have also been obtained.' These reflect variations in the surface condition and composition of the samples tested. This has led to the definition of a new term, the "apparent surface tension," which includes all effects not calculable from sample geometry. Thus it has been found that reproducible sample preparation is one of the prime difficulties of a dynamic method. Samples vary in viscosity as a result of differences in previous history, rate of elongation, and time after loading. When sample histories are made equivalent, then the other variations become reproducible even though they cannot be eliminated. (auth)

17843 WADC-TR-59-190(Pt. I)
Melpar, Inc., Falls Church, Va.
SYNTHESIS OF THERMALLY STABLE EPOXY RESINS FOR DIELECTRIC APPLICATIONS. Period covered: March 1, 1958 through February 28, 1959. Lee M. Kindley, Richard F. Marshall, Louis P. Glekas, and Paul E. Ritt. Feb. 1959. 119p. Project title: ELECTRICAL AND ELECTRONIC MATERIALS. Task title: ELECTRICAL AND ELECTRONIC ORGANIC MATERIALS. Contract AF33(616)-5518.

Literature sources have not revealed any phosphorus epoxide polymers or organo-phosphorus compounds containing more than one epoxide group. The characteristic thermal properties of commercial epoxy resins were obtained from Thermal Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), and Heat of Distortion values. Resins tested included Dow Epoxy Novalac X2638.3, Eccomold L 266, Stycast 2662, Epoxylite 813, Maraset 617, Sealcast 506, Epon X1310 laminate, Epon 828/PMDA-MA, Epon 828-Epon X1310/Diaminodiphenylsulfone, Epon 828-Triethanol Amine Titanate, and Permacel ST 3994. It was found that Thermal Gravimetric Analysis (TGA) as compared with Differential Thermal Analysis (DTA) had an inherent advantage for comparing the thermal stabilities of polymers. The (TGA) curves share a common, well-defined "knee" in the temperature range wherein disruptive volatilization first becomes rapid, thus enabling clearer

interpretation of degradation temperature. A number of products resulting from the reaction of tetrakis (hydroxymethyl) phosphonium chloride and epichlorohydrin in the presence of aqueous sodium hydroxide yielded water insoluble foams when cured with anhydride type curing agents. Although positive identification of these products has been a formidable problem, the fact that polymers have been formed from the reaction of a quaternary phosphonium compound and epichlorohydrin is encouraging. Even more promising results were observed in attempts to prepare a phosphorus containing epoxide by a two step reaction of tris (hydroxymethyl) phosphine oxide and epichlorohydrin. Conditions have been worked out for obtaining satisfactory yields in the first or acid catalyzed step, but more development work is required to define conditions for the second or ring closing step. (auth)

17844 WAL-TR-804/19
Watertown Arsenal Lab., Mass.
SPECTROCHEMICAL DETERMINATION OF ACID-SOLUBLE ALUMINUM IN LOW-ALLOY STEELS BY THE ROTATING-DISC METHOD. F. G. Howell. June 1959. 18p. DA Project 5B93-32-002. (AD-217440; PB-151812). $0.75(OTS).

A spectrographic method for the determination of acid-soluble aluminum in low-alloy steels was developed using a solution technique with a rotating graphite disc and a high-voltage alternating current spark. The method is rapid compared to chemical analysis, permitting a considerable saving in time. Of the common alloying elements used in low-alloy steels, only tungsten interferes. The method applies to samples containing 0.02 to 0.25% acid-soluble aluminum. (auth)

17845 WAPD-205
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE POLAROGRAPHIC DETERMINATION OF HEXAVALENT URANIUM IN URANIUM OXIDES; THE DETERMINATION OF OXYGEN URANIUM RATIOS. R. M. Burd and G. W. Goward. Apr. 1959. 11p. Contract AT-11-1-GEN-14. $0.50(OTS).

A method was developed for the determination of uranium(VI) in high-purity uranium oxides. Oxide samples are dissolved in hot, concentrated phosphoric acid, and then, the uranium(VI) is determined polarographically in a sulfuric-phosphoric acid medium with a dropping mercury electrode. The method provides an accurate means for determining oxygen–uranium ratios in high purity nominal uranium dioxide and has been applied to the analysis of raw uranium dioxide, fuel pellets used in the PWR Core 1 blanket, and a variety of oxides prepared for development work on ceramic fuel materials. The relative precision of the method at the 95% confidence level is ±4%, and the range of the method is from 0.2 to 20.0% uranium(VI) in the high-purity uranium oxides. (auth)

17846 AEC-tr-3728
HYDROGEN DISCHARGE OVERVOLTAGE AT Zr IN ACID AND ALKALINE SOLUTIONS. A. M. Murtazaev and T. K. Azizova. Translated for Phillips Petroleum Co. from Uzbek. Khim. Zhur., Akad. Nauk Uzbek. S.S.R. No. 3, 69-74(1958). 8p. $1.80(ph), $1.80(mf) LC or JCL.

The hydrogen overvoltage of Zr was measured at current densities ranging from 10^{-5} to 10^{-1} amp/cm^2 in neutral, acidic, and basic solutions. Zirconium is readily passivated in alkaline solutions. It was shown that when the acid concentration is increased by a factor of 10, the hydrogen overvoltage of Zr is diminished by ~60 millivolts, and by 75 millivolts in the case of the alkali. (W.L.H.)

17847 AEC-tr-3741
REACTION OF TITANIUM TETRACHLORIDE WITH CHLORIDES OF TANTALUM, NIOBIUM, AND ALUMINUM. I. S. Morozov and D. Ya. Toptygin. Translated for Los Alamos Scientific Lab. from Zhur. Neorg. Khim. 2, 1915-21(1957). 9p. $1.80(ph), $1.80(mf) JCL or LC.

The solubility of chlorides of Ta, Nb, and Al in $TiCl_4$ was investigated. Methods used were thermal analysis and solubility. The solubility of $TaCl_5$ and $NbCl_5$ are of the same order of magnitude, and the solubility of $NbOCl_3$ is a few hundredths percent at low temperatures. $AlCl_3$ and NaCl react in a $TiCl_4$ solution. The solubility of $TaCl_5$ and $NbCl_5$ in $TiCl_4$ is increased in the presence of $AlCl_3$. Phase diagrams of $TiCl_4$–$NbCl_5$–$AlCl_3$ and $TiCl_4$–$TaCl_5$–$AlCl_3$ systems are included. (J.R.D.)

17848 AEC-tr-3743
ISOMORPHISM BETWEEN OXIDES OF TETRAVALENT METALS IN THE SYSTEM: CeO_2–ThO_2; CeO_2–ZrO_2–HfO_2. (Isomorfismo tra ossidi di metalli tetravalenti. I sistemi: CeO_2–ThO_2; CeO_2–ZrO_2; CeO_2–HfO_2.) L. Passerini. Translated for Oak Ridge National Lab. from Gazz. chim. ital. 60, 762-7(1930). 14p. (Includes original, 6p.). $3.30(ph), $2.40(mf) JCL.

The diameters of the Ce^{4+} and Th^{4+} ions, as they are calculated from the oxides, are 2.05 and 2.20 A, respectively, with a difference, with respect to the smaller, of 7.3%. This slight difference explains the complete miscibility of CeO_2–ThO_2 system. The oxides CeO_2 and ZrO_2, because of the difference in diameters of the Ce^{4+} and Zr^{4+} ions, 2.05 and 1.74 A, respectively, 17.75% with respect to the smallest ion, are only partially soluble in the solid state. (W.L.H.)

17849 AEC-tr-3744
REMOVAL OF OXYGEN FROM GASES WITH ACTIVATED COPPER. F. R. Meyer and Grete Ronge. Translated by Jerome O'Laughlin (Ames Lab.) from Angew. Chem. 52, 637-8(1939). 7p. $1.80(ph), $1.80(mf) JCL.

Copper preparations which combine with oxygen very actively are described. These were used to prepare an oxygen absorbent which removes oxygen from gases such as nitrogen, hydrogen, the noble gases, and others. Activation procedure is given, and the examination of the purified gases for oxygen is described. (J.R.D.)

17850 CEA-tr-R-686
ECHANGEURS D'IONS SÉLECTIFS ET MEMBRANES SÉLECTIVES A ÉCHANGEURS D'IONS. (Selective Ion Exchangers and Ion Exchanger Membranes.) V. A. Klyatchko (Kliatchko). Translated into French from Zavodskaya Lab. 23, 1049-51(1957). 10p.

It is possible to increase the efficiency of the ion exchange separation of similar ions by the utilization of special selective ion exchangers or ion exchange selective membranes. The fabrication of some selective exchangers is briefly reviewed. The use of electrodialysis in conjunction with ion exchange membranes which are selectively permeable is described, and the design of the cells used is given. (J.S.R.)

17851 SCL-T-252
CONCERNING A NEW ACID RELATED TO THE PICRIC ACID (TRINITROPHENOL). (Ueber eine neue, der Pikrinsäure nahestehende Säure.) Rudolph

Böttger and Heinrich Will. Translated by Marcel I. Weinreich (Sandia Corp.) from Ann. Chem. Pharm. 58, 273-300(1846). 31p. $6.30(ph), $3.00(mf) JCL.

Styphnic acid ($C_{12}H_2N_3O_{15}$, HO) originates through the effect of HNO_3 on various resins. The acid is closely related to picric acid, as far as its composition and behavior are concerned. Preparation, properties, and the composition of styphnic acid are presented. The preparation of styphnic salts is described. (W.L.H.)

17852 SCL-T-255

ON THE COMPOSITION OF COMPLEX SILVER IONS IN CONCENTRATED ALKALI SOLUTIONS. (O Sostave Kompleksnogo iona serebra v Sil'noshchelochnykh Rastvorakh.) Yu. V. Pleskov and B. N. Kabanov. Translated by Marcel I. Weinreich (Sandia Corp.) from Zhur. Neorg. Khim. 2, 1807-11(1957). 12p. $3.00(ph), $2.40(mf) JCL or LC.

It has been demonstrated that a complex ion of monovalent silver in KOH solutions from 3 to 15 ml has the following composition: $[Ag_3O(OH)_2]^-$. With the aid of a rotating disk electrode, the diffusion coefficient of this complex ion as a function of the concentration of KOH within the range between 3 and 15 ml was measured. The solubility of Ag_2O in KOH solutions between 3 and 15 ml was measured. (W.L.H.)

17853

OXIDATION OF UO_2 TO U_3O_8. R. E. DeMarco, H. A. Heller, R. C. Abbott, and W. Burkhardt (National Lead Co. of Ohio, Cincinnati). Am. Ceram. Soc. Bull. 38, 360-2(1959) July.

The oxidation, at temperatures below 500°C, of uranium dioxide to triuranium octaoxide has been shown to proceed through the formation of the stable intermediate compound, triuranium heptaoxide. Experimental data indicate that U_3O_7 is the only true Daltonide compound existing in the range: UO_2 to U_3O_8. (auth)

17854

THERMOMETRIC TITRATION OF URANIUM(IV) WITH POTASSIUM DICHROMATE. F. J. Miller and P. F. Thomason (Oak Ridge National Lab., Tenn.). Anal. Chim. Acta 21, 112-16(1959) Aug.

A thermometric method is presented for the redox titration of uranium(IV) with dichromate. The investigation was made primarily to determine the applicability of the thermometric method to redox titrations in solutions that contain ions deleterious to electrodes used in electrometric methods. A relative standard error of ±1% is attainable in the titration of quantities of uranium(IV) of the order of 5 mg. Less than 15 min is required to complete a titration. Fluoride ion can be tolerated in the solution provided that sufficient aluminum(III) is added to complex all the fluoride. (auth)

17855

DETERMINATION OF NIOBIUM AND TANTALUM IN BINARY ALLOYS AND ZIRCONIUM ALLOYS. D. F. Wood and I. R. Scholes (Imperial Chemical Industries, Ltd., Birmingham, Eng.). Anal. Chim. Acta 21, 121-35(1959) Aug.

Recent developments in the metallurgy of niobium, tantalum, and zirconium have necessitated provision of analytical procedures for determining niobium and tantalum in the presence of each other and in the presence of zirconium. For this purpose, absorptiometric procedures based on the formation of yellow colored complexes between pyrogallol and niobium or tantalum have been critically examined. Direct absorptiometric procedures are described, which are suitable for determining niobium or tantalum in the range 2 to 7%; when either of these metals exceeds 7%, differential absorptiometric procedures are recommended. Corrections must be made for absorption due to the presence of other metals which form complexes with pyrogallol. In the determination of niobium or tantalum up to 5%, the precision of the method is about ±0.05%. About 12 determinations can be made in a day, by one analyst. (auth)

17856

THERMOCHEMISTRY AND THERMODYNAMIC PROPERTIES OF SUBSTANCES. Martin A. Paul (Harpur Coll., Endicott, N. Y.). Ann. Rev. Phys. Chem. 9, 1-26 (1958).

A literature survey, concluded in December 1957, is offered. Apparatus and technique developments, state data, heat capacities, thermochemical and related data, applications of mass spectrometry, and free energy and related equilibrium data are reviewed. An extensive tabulation of compounds, properties investigated, and temperature range investigated is presented with bibliographic references. 313 references. (T.R.H.)

17857

CRYOGENICS. H. A. Fairbank (Yale Univ., New Haven) and M. J. Buckingham and W. M. Fairbank (Duke Univ., Durham, N. C.). Ann. Rev. Phys. Chem. 9, 27-44(1958).

A literature review of certain selected topics in cryogenics is presented which was concluded in February 1958. The topics are: superconductivity and quantum liquids (liquid He^4 and He^3). 120 references. (T.R.H.)

17858

THE SOLID STATE. Lester Guttman (General Electric Research Lab., Schenectady, N. Y.). Ann. Rev. Phys. Chem. 9, 73-92(1958).

Selected areas of solid state research are reviewed in this literature survey concluded December 1957. These areas are: general theory of crystals, experimental determination of electronic structure, elastic properties of crystals, electronic transport phenomena, magnetism (except diamagnetism), diffusion, and imperfections. 200 references. (T.R.H.)

17859

RADIATION CHEMISTRY. Marc Lefort (Faculté des Sciences, Paris). Ann. Rev. Phys. Chem. 9, 123-56 (1958).

A review on radiation chemistry, concluded in November 1957, is presented. The scope is indicated by these topics: gases, organic compounds in liquid phase, organic and inorganic solids, hot atom chemistry, water and inorganic aqueous solutions, aqueous solutions of organic compounds, and dosimetry and irradiation facilities. 188 references. (T.R.H.)

17860

ION EXCHANGE RESINS AND MEMBRANES. William J Argersinger, Jr. (Univ. of Kansas, Lawrence). Ann. Rev. Phys. Chem. 9, 157-78(1958)

A literature survey concluded in December 1957 is presented. The following topics were reviewed: mineral exchangers, preparation and properties of resins, theory, kinetics, and equilibrium, membranes, polyelectrolytes, inorganic studies and complexes, separations and analytical applications, and catalysis. 238 references. (T.R.H.)

17861

REACTION KINETICS AND MECHANISMS OF GAS PHASE REACTIONS. David Garvin (Princeton Univ.,

N. J.). Ann. Rev. Phys. Chem. 9, 201-20(1958).

The scope of this literature survey concluded in December 1957 is indicated by these topics reviewed: rate theory, dissociation and recombination reactions, unimolecular reactions, intermolecular energy exchange, primary processes in organic reactions, bimolecular reactions, and organic free radicals. 91 references. (T.R.H.)

17862

REACTION KINETICS IN SOLUTION. Antonino Fava (Univ. of Padua). Ann. Rev. Phys. Chem. 9, 221-44 (1958).

A literature survey completed in November 1957 is presented. The topics covered are: medium effects, isotope effects, inorganic reactions, and organic reactions. 219 references. (T.R.H.)

17863

QUANTUM THEORY OF ELECTRONIC STRUCTURE OF MOLECULES. Masao Kotani, Yukio Mizuno, Kunifusa Kayama, and Hiroyuki Yoshizumi (Univ. of Tokyo). Ann. Rev. Phys. Chem. 9, 245-64(1958).

A review is presented which covers recent development in the theory of electronic structure of molecules. The literature survey was concluded in December 1957. Recent studies on the He atom are treated first, then nonempirical theory of simple molecules. Various semiempirical theories of molecules are discussed next, and results of calculations of various molecular constants are then reviewed. 83 references. (T.R.H.)

17864

MOLECULAR ELECTRONIC SPECTRA. G. Herzberg (National Research Council, Ottawa). Ann. Rev. Phys. Chem. 9, 315-38(1958).

A review is presented based on a literature survey concluded in December 1957. The emphasis is on simpler molecules and the results of fine structure investigations. Topics treated under Diatomic Molecules are: analyses of band systems, dissociation and predissociation, forbidden transitions, intensities, and theoretical work. Under Polyatomic Molecules these sub-topics are reviewed: vibrational and rotational structure of electronic transitions, dissociation, predissociation, and ionization, and theoretical work. 215 references. (T.R.H.)

17865

SPECTROSCOPY. M. Kent Wilson and Victor A. Crawford (Tufts Univ., Medford, Mass.). Ann. Rev. Phys. Chem. 9, 339-58(1958).

A review, based on a literature survey concluded in mid-January 1958, is presented. These topics are treated: rotation spectra, vibration spectra, and intensities. 207 references. (T.R.H.)

17866

CUTTING THE COST OF HEAVY WATER. AN ATOMIC WORLD SURVEY. Atomic World 9, 382-5 (1958) Nov.

Some new heavy water processes, proposed and actually in operation, are discussed. A British process which can be operated economically on a relatively small scale is described. The plant is operated in conjunction with an ammonia synthesis plant. The extraction of deuterium from ammonia synthesis gas and the first stage of concentration to 23 times the natural concentration are accomplished by flowing, countercurrently, hydrogen, contained in ammonia synthesis gas, and liquid ammonia containing a potassium amide catalyst. Further concentration up to 75% deuterium–hydrogen is by ammonia distillation, while the final purification is a water distillation in a Kuhn-type column. Schematic flowsheets are given, which show the exchange and distillation sections of the plant. Discussions are included on: concentration changes of the deuterium in the ammonia, cooling the mixed gas, vapor serving as a heating medium, and column packing. America's Savannah River plant is discussed as well as some research that is being conducted on the ammonia synthesis gas process. India is constructing a heavy water plant that is combined to produce 14 tons per year as well as 70,000 tons of nitrogen fertilizer in the form of nitro-limestone. Design figures give this process an over-all recovery efficiency for D_2O of 55.6%. (J.H.M.)

17867

RAPID METHODS IN THE ANALYSIS OF METALS AND MINERAL RAW MATERIALS. VIII. DETERMINATION OF SMALL AMOUNTS OF URANIUM IN MINERAL RAW MATERIALS. Z. Šulcek, J. Michal, and J. Doležal (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 1815-21(1959) June. (In German)

A rapid method for the separation of small amounts of uranium in silica gel columns was perfected. The other elements are removed by means of (ethylenediamine)tetraacetic acid and tartrate. The final determination was made polarographically. (tr-auth)

17868

INFLUENCE OF THE NATURE OF CARBON BLACK ON ITS RADICAL CHARACTER. Jean-Baptiste Donnet, Gaston Henrich, and Louis Geldreich. Compt. rend 249, 97-8(1959) July 6. (In French)

Ten carbon blacks of widely differing compositions, surfaces, and particle sizes were studied. It was found that there is no relation between surface area and number of free radicals. Also, the free electrons are located uniquely on the surface. No relation between the ratios hydrogen/carbon and radicals/carbon was found. The data presented show that the strengthening of rubber by some carbon blacks is not due to surface radicals as reported by others. (T.R.H.)

17869

REDUCTION OF BORON TRIFLUORIDE BY CALCIUM HYDRIDE. Paul Hagenmuller and Robert de Pape (Faculté des Sciences, Rennes, France). Compt. rend. 249, 114-16(1959) July 6. (In French)

The reduction of BF_3 by CaH_2 begins at 225°C by formation of B_2H_6 which decomposes to hydrogen plus higher boranes. Starting at 300°C, the reaction produces amorphous B. Above 700°C the B reacts with an excess of hydride to produce CaB_6. (tr-auth)

17870

DIRECT DETERMINATION OF ALUMINUM IN SILICATES BY FLAME SPECTROPHOTOMETRY. Jeannine Debras-Guédon and Igor Voinovitch. Compt. rend. 249, 242-4(1959) July 15. (In French)

The emission of Al in the oxy-acetylene flame is too weak in most cases. An addition of oxine in a significant quantity raises this emission to a level where sensitivity sufficient to determine Al is obtained. The reagent also has the property of permitting a direct analysis, without any previous separation, and with good reproducibility. (tr-auth)

17871

THE EFFECTS OF OXYGEN ON THE ELECTROCHEMICAL BEHAVIOR OF STAINLESS STEELS IN

SULFURIC ACID. Philippe Berge. Compt. rend. 249, 262-4(1959) July 15. (In French)

Polarization curves of 18-8 steels and measurements of the degree of passivity in coulombs/cm^2 for deaerated H_2SO_4 are given. It is established that the rapid depassivation observed in acid media deprived of dissolved oxygen is due to a reduction of the passivating layer in the absence of stronger oxidants. Therefore the depassivation is not due to liberation of previously adsorbed O_2. (tr-auth)

17872

EFFECTS OF X RAYS (18.5 kev) ON AQUEOUS SOLUTIONS OF BENZOQUINONE AND HYDROQUINONE. Catherine Vermeil and Louis Salomon (Institut du Radium, Paris). Compt. rend. 249, 268-70(1959) July 15. (In French)

Aqueous solutions of quinone (Q)–hydroquinone (H_2Q) and benzoquinone (BQ) were irradiated to doses from 1 to 2×10^{17} ev/cm^3/min under air and under H_2. The high stability of the H_2Q in the absence of air is interpreted by reactions in which the formation of H_2O_2 and H_2 exerts a protective effect. In air at pH above 2.5, O_2^- plays the same reductor role as H; at lower pH the increased H_2O_2 yield is explained by: $HQ + HO_2 \rightarrow Q + H_2O_2$. For Q under H_2 the high G_{H_2Q} even at low concentrations seems to justify these reactions: $H_2 + OH \rightarrow H + H_2O$; $Q + H \rightarrow HQ$; and $2QH \rightarrow Q + H_2Q$. In the absence of O_2 the decrease of the G_{H_2Q}/G_{-Q} ratio indicates that the OH causes degradation reactions. In O_2 at low acidity, the fact that the yields are about the same as without O_2 leads one to think that O_2^- reduces Q. For BQ the yields in presence and absence of O_2 were within the limit of experimental error (< 10%). Under H_2 the influence of pH becomes negligible and reduction represents the quasi-completeness of the transformation. (T.R.H.)

17873

PRODUCTION OF HEAVY WATER UNDER SEMI-INDUSTRIAL CONDITIONS. Kalman Czike and Mrs. Jozsef Fodor (State Research Inst. of Physics). Energia es Atomtech. 11, 503-6(1958). (In Hungarian)

An electrolytic method of D_2O production for industrial uses is described. (R.V.J.)

17874

IMPROVEMENT OF SEVERAL ANALYTICAL METHODS USED IN THE NUCLEAR METAL INDUSTRY. Jacques Robin (Centre de recherches d'Ugine, Lyon). Énergie nucléaire 1, 72-6(1959) May-June. (In French)

Several examples of analytical control related to the nuclear energy industry are given. Corrosion of steel by molten Na at high temperatures can be evaluated either by direct study of the steel (weight variation or metallography) or by analysis of the Na before, during, and after the test. The apparatus used for sampling the Na and its operation are described. For purity control of Zr and its alloys—determination of low and very low concentrations of impurities—the spectrographic method is preferable to chemical analysis. Determinations run on UF_4 are also discussed. (tr-auth)

17875

PREPARATION OF CRYSTALS OF U_3O_8 AND STUDY OF THEIR STRUCTURE. B. Chodura, H. Landsperský, V. Macháček, and J. Malý (l'Académie Tchécoslovaque des Sciences, Prague). Énergie nucléaire 1, 101-4(1959) May-June. (In French)

The process for preparation of U_3O_8 was studied, and single crystals of 1 to 10μ in diam. were obtained. The effects of starting material, temperature, and time of heating on the size and structure of the crystals and particles obtained were studied. Measurements were made using optical and electron microscopes and radiography. The important influence of a high temperature and prolonged heating on the dimensions of the product was verified. Examples of typical values obtained are given. (tr-auth)

17876

STUDIES OF THE REACTION OF CERIUM PYROPHOSPHATE FORMATION. V. M. Tarayan and L. A. Eliazyan (Erivan State Univ.). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Khim. Nauk 11, 243-8(1958). (In Russian)

The compositions of compounds formed in pyrophosphate interactions with cerium and ceric ions were determined. Potentiometric and amperometric titration methods were used for determining the composition of difficultly soluble ceri- and cero-phosphates. (R.V.J.)

17877

NON-SPECIFIC SALT EFFECTS IN POLAROGRAPHIC REDUCTIONS. W. H. Reinmuth, L. B. Rogers, and L. E. I. Hummelstedt (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 81, 2947-53(1959) June 20.

A recent theory of the electron-transfer process proposed by Marcus is examined with respect to its implications in the polarographic process. A discussion is given of the effects of supporting electrolyte on electron-transfer controlled waves. Qualitative and in some cases semi-quantitative explanations are offered for the effect of medium on half-wave potentials and slopes of waves. (auth)

17878

COÖRDINATION PROPERTIES OF THE THIOCYANATO RADICAL. I. THE BONDING OF SILVER AND MERCURY IONS BY THIOCYANATO COMPLEXES OF COBALT(III) AND CHROMIUM(III). W. C. Waggener, J. Arthur Mattern, and G. H. Cartledge (Oak Ridge National Lab., Tenn. and Univ. of Buffalo). J. Am. Chem. Soc. 81, 2958-66(1959) June 20.

Silver(I) and mercury(II) ions have been found to produce color changes in solutions of cis- and trans-dithiocyanatoamminecobalt(III) salts and in the corresponding salts of chromium(III) similar to those already known for mono-thiocyanatoamminecobalt(III) salts with silver(I) ion. The nature and stability of the interaction species occurring in the solutions have been studied spectrophotometrically using the method of continuous variations. The effects of acidity and ionic strength were found to be as expected from the hydrolytic nature of the ions and the Debye–Hückel theory. The effects of light and metal ions (viz., Ag(I) or Hg(II) upon the stability of solutions of $[Co(NH_3)_5NCS](NO_3)_2$ and $[Cr(NH_3)_5NCS](NO_3)_2$, respectively, have been compared. The nature of the reaction and the identity of type established between the cobalt and chromium series of complexes are used to infer that both series have the isothiocyanato structure. (auth)

17879

STRUCTURE OF THE REACTION PRODUCT OF PHENYLACETYLENE WITH IRON PENTACARBONYL. J. R. Leto and F. A. Cotton (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 81, 2970-3 (1959) June 20.

A compound first prepared by Jones, Wailes, and Whiting in 1955 has been further studied. It is concluded from analytical data that its formula is $C_{20}H_{12}O_4Fe$ and not $C_{20}H_{10}O_4Fe$. Detailed study of the infrared spectrum and the fact that it has a dipole moment of ~3

Debye units lead to the proposal of a structure in which a diphenylcyclopentadienone is bonded by π electrons to an $Fe(CO)_3$ group. (auth)

17880

STABILITY AND SYNTHESIS OF PHENYLBORONIC ACIDS. A. H. Soloway (Massachusetts General Hospital, Boston and Harvard Univ., Boston). J. Am. Chem. Soc. 81, 3017-19(1959) June 20.

The preparation of several substituted carboxyphenylboronic acids is described. The marked stability of the carbon–boron bond in such compounds is noted. Three boron-containing compounds with potential carcinostatic properties have been synthesized. (auth)

17881

KINETICS OF THE OXIDATION OF URANIUM(IV) BY THALLIUM(III). A. C. Harkness and J. Halpern (Univ. of British Columbia, Vancouver, Can.). J. Am. Chem. Soc. 81, 3526-9(1959) July 20.

The kinetics of the reaction U(IV) + Tl(III) → U(VI) + Tl(I) were examined in aqueous perchloric acid solution and found to be of the form $-d[U(IV)]/dt = [U^{4+}][Tl^{3+}](k_1[H^+]^{-1} + k_2[H^+]^{-2})$. The two rate constants were identified with reaction paths involving activated complexes of the compositions $(U{\cdot}OH{\cdot}Tl)^{8+}$ and $(U{\cdot}O{\cdot}Tl)^{5+}$, respectively. The corresponding heats and entropies of activation, evaluated from rate measurements over the temperature range 16 to 25°, are $\Delta H_1^* = 24.6$ kcal./mole, $\Delta H_2^* = 21.7$ kcal./mole, $\Delta S_1^* = 16$ e.u. and $\Delta S_2^* = 7$ e.u. The effect of ionic strength and the specific effects of various anions and cations on the rate were examined. The results suggest, but do not demonstrate conclusively that the reaction occurs through a single two-equivalent step rather than through successive one-electron changes. (auth)

17882

THE HEAT CAPACITY AND THERMODYNAMIC FUNCTIONS OF β-URANIUM HYDRIDE FROM 5 TO 350°K. Howard E. Flotow, Harold R. Lohr, Bernard M. Abraham, and Darrell W. Osborne (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 81, 3529-33(1959) July 20.

The heat capacity of β-UH_3 was measured from 5 to 350°K in an adiabatic calorimeter. The enthalpy and entropy at 298.15°K calculated from the data are 2155 cal. $mole^{-1}$ and 15.24 cal. $deg.^{-1}$ $mole^{-1}$, respectively. The entropy and free energy of formation for UH_3 at 298.15°K as well as the heat of formation at absolute zero were calculated from these data and the previously determined heat of formation and have the values −43.60 cal. $deg.^{-1}$ $mole^{-1}$, −17,353 cal. $mole^{-1}$ and −27,945 cal. $mole^{-1}$. It was found that the calculated and observed dissociation pressures are not in agreement. The discrepancy is believed due to a particle size effect in the dissociation pressure measurements or to the heat of transition from α-UH_3 to β-UH_3. An anomaly is observed in the heat capacity which arises from the transition from the ferromagnetic to the paramagnetic state. The maximum in the heat capacity is 10.72 cal. $deg.^{-1}$ $mole^{-1}$ and occurs at 170.7 ± 0.5°K. It was estimated that 1.01 cal. $deg.^{-1}$ $mole^{-1}$ is the entropy change in the transition which is less than R ln 2 = 1.38 cal. $deg.^{-1}$ $mole^{-1}$ expected from the Heisenberg theory of ferromagnetism. (auth)

17883

SYSTEMATICS IN THE CHEMISTRY OF THE BORON HYDRIDES. R. W. Parry and L. J. Edwards (Callery Chemical Co., [Penna.] and Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 81, 3554-60(1959) July 20.

Stock originally recognized two groups of boron hydrides, the B_nH_{n+4} and B_nH_{n+6} series. This classification has been extended and used as a basis for the systematic arrangement of the boron hydrides. Four types of chemical reactions of the boron hydrides are recognized. These are: (1) symmetrical cleavage of the double bridge bond, (2) non-symmetrical cleavage of the double bridge bond, (3) loss of a proton from a hydrogen bridge bond, and (4) loss of molecular hydrogen from the molecule. The type of reaction expected from a given molecule is related to the position of the molecule in the systematic arrangement and to the geometry of the original boron hydride. (auth)

17884

SOLUBILITY OF NITROGEN IN FREON-114. Vaughn D. Williams (Goodyear Atomic Corp., Portsmouth, Ohio). J. Chem. Eng. Data 4, 92-3(1959) Jan.

Nitrogen has been injected into the cell coolant systems at various times to lower the condenser heat transfer coefficient on the freon side, thus making it possible to increase water velocity. Difficulty was encountered in removing the injected N_2 by venting, and results of analysis of freon in the cells indicate that an appreciable amount of N_2 dissolves in the liquid phase. The equilibrium solubility of N_2 in Freon-114 at various temperatures was determined. (W.L.H.)

17885

KNALLGAS AND KNALLGAS–STEAM MIXTURES AT HIGH INITIAL TEMPERATURE AND PRESSURE. CALCULATED DETONATION PARAMETERS AND ADIABATIC CONSTANT-VOLUME EXPLOSION PROPERTIES. James A. Luker, Paul L. McGill, and Leonard B. Adler (Syracuse Univ., N. Y.). J. Chem. Eng. Data 4, 136-42(1959) Apr.

Detonation parameters and adiabatic constant-volume explosion properties are calculated for knallgas ($2H_2-O_2$) and knallgas saturated with steam. Gas mixtures which could be produced under typical reactor operating conditions were considered. This range of interest covered the region from room temperature and atmospheric pressure to 300°C and 150 atm. (W.L.H.)

17886

VISCOSITY OF HELIUM, OXYGEN, HELIUM–OXYGEN, HELIUM–STEAM, AND OXYGEN–STEAM MIXTURES AT HIGH TEMPERATURES AND PRESSURES. James A. Luker and Charles A. Johnson (Syracuse Univ., N. Y.). J. Chem. Eng. Data 4, 176-82(1959) Apr.

The first phase of this investigation was the determination of the viscosity of He and O_2 at elevated pressures over a temperature range of 200 to 450°C. The second phase was the determination of the viscosity of $He-O_2$, steam–He, and steam–O_2 mixtures at elevated pressures and temperatures. (W.L.H.)

17887

STUDY OF THE KINETICS OF DEUTERIUM EXCHANGE BETWEEN LIQUID WATER AND GASEOUS HYDROGEN SULFIDE. J. Garaud and R. Amanrich (Office National Industriel de l'Azote, Toulouse, France). J. chim. phys. 56, 532-47(1959) June. (In French)

The kinetics of D exchange between $H_2O(l)$ and $H_2S(g)$ was studied in an apparatus simulating one bubble-plate of the classic type. Experimental and theoretical study of the whole process of D transfer between liquid and gas phase has led to a semi-empirical expression giving the value of the plate efficiency as a function of different operational parameters (geometric characteristics of

the plates, gaseous flow, temperature, pressure). These results can be applied to the calculation of a column of industrial size. It was found that certain products (NH_3 and amines in particular) speed up the exchange remarkably. Study of this effect showed that the isotopic exchange mechanism is completely explained by the Brodsky theory, according to which the H_2 is produced because of a transfer of protons between non-ionized molecules provided that the atom bound to hydrogen has a free electron pair. (tr-auth)

17888

STUDY OF THE BeH RADICAL BY THE SELF-COHERENT FIELD METHOD. Sergio Aburto, Rolando Gallardo, and Reinaldo Muñoz (Université du Chili, Santiago) and Raymond Daudel and Roland Defebvre (Centre de Mécanique Ondulatoire Appliquée, Paris). J. chim. phys. 56, 563-7(1959) June.

The method of self-coherent fields is applied to the BeH radical in the approximation of the linear combinations of atomic orbitals. A number of approximations which permit elimination of certain atomic integrals particularly difficult to calculate, and some other simplifications of calculation lead to a wave function containing only strictly orthogonal molecular orbitals. The calculation was repeated for four interatomic distances. The equilibrium distance calculated was 1.34 A (experimental value 1.33 A) and the bond energy 2.75 ev (experimental value 2.2 ev). The calculated energy of ionization was 8.43 ev (experimental value 8.1 ev). (tr-auth)

17889

THE PROPERTIES OF PROTACTINIUM(V) IN ALKALINE SOLUTIONS. Z. Jakovac and M. Lederer (Institut du Radium, Paris). J. Chromatog. 2, 411-17(1959) July.

The paper chromatography, paper electrophoresis, anion exchange, solvent extraction, and precipitation reactions of tracer quantities of protactinate are described with experimental results in graphic form. (auth)

17890

COAGULATION AND ELECTROKINETIC POTENTIAL OF URANYL FERROCYANIDE SOL. B. N. Ghosh and P. K. De (University Coll. of Science and Tech., Calcutta). J. Indian Chem. Soc. 36, 171-5(1959) Mar.

The apparent electrokinetic potential, ζ_a, of a uranyl ferrocyanide sol has been measured by the electro-osmotic and electrophoretic methods in the region of slow coagulation using Smoluchowski's equation in the presence of equicoagulating concentrations of electrolytes containing counter ions of different valency. ζ_a has also been measured in the region of rapid coagulation by the electro-osmotic method. The results lead to the conclusion that a given rate of coagulation of uranyl ferrocyanide sol by different electrolytes is characterized by a definite value of the true ζ potential, independent of the valency of the counter ions used. It has also been found that the difference in the values of true ζ potential for the slow and rapid rates of coagulation is quite small. This indicates the existence of a critical zone of ζ potential for the coagulation of the colloid. (auth)

17891

ELECTRONEGATIVITIES CALCULATED USING A MODIFICATION OF PAULING'S EQUATION. M. A. Fineman and R. Daignault (Providence Coll.). J. Inorg. & Nuclear Chem. 10, 205-14(1959) May.

An equation for calculating the electronegativity of an element is developed from Pauling's relationship between the extra-ionic resonance energy and the electronegativity differences in which the bond energy of a metal-metal single bond need not be known nor any assumptions need be made concerning it. From this relationship the electronegativity of fifty-four elements has been calculated. In addition, electronegativities of different oxidation states of six elements have been calculated. A brief discussion concerning the possibility of alternation of electronegativities in Groups IV B and V B is presented. (auth)

17892

A LAMELLAR COMPOUND OF SODIUM AND GRAPHITE. R. C. Asher (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 10, 238-49(1959) May.

A previously unknown compound of sodium and graphite, having an ideal formula $C_{64}Na$, is described. It has a lamellar structure in which sodium is intercalated in every eighth interplanar gap and appears to be analogous to the K–, Rb–, and Cs–graphite lamellar compounds. The main evidence for its existence and structure is from x-ray diffraction studies, supported by magnetic susceptibility determinations and measurements of the dilation occurring when graphite is immersed in sodium. (auth)

17893

THE PREPARATION AND INFRA-RED ABSORPTION SPECTRA OF SEVERAL COMPLEXES OF BIS-(2-ETHYLHEXYL)-PHOSPHORIC ACID. D. F. Peppard and J. R. Ferraro (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 10, 275-88(1959) May.

The bis(2-ethylhexyl)phosphates of Li(I), Na(I), K(I), $Co(NH_3)_6$(III), $Co(en)_3$(III), Sc(III), Zr(IV), Hf(IV), Th(IV), and U(VI) have been prepared. The mixed nitrate-bis-(2-ethylhexyl)phosphates of Zr(IV), Hf(IV), Ce(IV), Ce(IV), and Th(IV) were also prepared. The infrared absorption spectra of all these compounds were obtained, and the antisymmetric POO^- stretching vibrations were compared. The POO^- stretching vibration frequencies of the bis(2-ethylhexyl)-phosphates of Sc(III) and Th(IV) were found to be similar to those found for the alkali metal salts and cobaltic salts, indicating high ionic character of the metal to oxygen bond of the phosphate. The bonding to the phosphate of the Hf(IV) and Zr(IV) complexes appears to be of a more covalent character. It is concluded that the nitrate in the mixed compounds is co-ordinated to the metal atom and that the metal-to-nitrate bond is essentially covalent. The bonding to the phosphate in the mixed compounds appears to be different from that in the pure phosphates. Recently the organophosphoric acids have been demonstrated to have interesting solvent properties for various inorganic salts. In particular HDEHP has been the subject of several studies. The present study involves the extraction from neutral aqueous solutions of the chlorides and nitrates of Sc(III), Zr(IV), Hf(IV), Th(IV), Ce(IV), and U(VI) by HDEHP. The complexes formed in the saturated solutions were determined, and their infrared spectra were investigated. For comparison, the salts of HDEHP with Li(I), Na(I), K(I), $Co(en)_3$(III), and $Co(NH_3)_6$(III) were also prepared and their infrared spectra obtained. (auth)

17894

THE CHEMISTRY OF PROTACTINIUM. V. A COMPARISON OF THE EXTRACTION OF PROTACTINIUM, NIOBIUM AND TANTALUM. A. T. Casey and A. G. Maddock (Chemical Lab., Cambridge, Eng.). J. Inorg. & Nuclear Chem. 10, 289-305(1959) May.

A quantitative comparison has been made of the ex-

traction of niobium, tantalum, and protactinium from solution in hydrochloric acid by di-isopropylcarbinol. The effects of acid, hydrogen ion, and chloride ion concentrations are reported, as well as the effect of the addition of fluoride ions. Similar data on the extraction of protactinium from bromide, sulfate, and oxalate solutions are included. The results are discussed in terms of the theories of solvent extraction of Irving and Rosotti and of Diamond, and complex ions of protactinium that might account for the results are suggested. (auth)

17895

THE EXTRACTION OF SOME METAL CHLORIDES INTO TRI-n-BUTYL PHOSPHATE. H. Irving and D. N. Edgington (Inorganic Chemistry Lab., Oxford). J. Inorg. & Nuclear Chem. 10, 306-18(1959) May.

The extraction of the chlorides of Fe^{3+}, Co^{2+}, Ni^{2+}, Cu^{2+}, Zn^{2+}, UO_2^{2+}, and In^{3+} from hydrochloric acid into a mixture of tri-n-butyl phosphate and diluents has been studied using radioactive tracers except for nickel, copper, and uranium, which were determined spectrophotometrically. The formula of the species extracted from a solution of cobalt in hydrochloric acid was found to be $CoCl_2 \cdot 2TBP$. The extraction of hydrochloric acid itself has been compared with that of nitric acid under comparable conditions. (auth)

17896

THE NATURE OF THE NITRATE IN THE TBP SOLVATES $M(NO_3)_3 \cdot 3TBP$, $M(NO_3)_4 \cdot 2TBP$ AND $MO_2(NO_3)_2 \cdot 2TBP$. J. R. Ferraro (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 10, 319-22 (1959) May.

An examination of the infrared spectra of the TBP solvates $M(NO_3)_3 \cdot 3TBP$, $M(NO_3)_4 \cdot 2TBP$, and $MO_2(NO_3)_2 \cdot 2TBP$ has been made and compared with the infrared spectra of the corresponding hydrates. It is observed that a considerable decrease in symmetry of the nitrate group has occurred in going from the hydrates to the TBP solvates. (auth)

17897

THE SEPARATION OF MIXTURES OF ORDINARY AND HEAVY WATER BY ZONE REFINING. Hilton A. Smith and Carl O. Thomas (Univ. of Tennessee, Knoxville). J. Phys. Chem. 63, 445-7(1959) Mar.

Experiments and calculations evaluating zone melting as a process for separating D_2O from H_2O are described. The experiments were done with an equimolar H_2O-D_2O mixture in a Tygon tube spiral in a cooling bath. A mathematical analysis using Birman's matrix method was employed. It was concluded that the process is so slow that its use may be limited to theoretical studies or the procurement of ultra pure samples. (T.R.H.)

17898

THE PHASE DIAGRAM OF THE CERIUM–CERIUM TRICHLORIDE SYSTEM. G. W. Mellors and S. Senderoff (National Carbon Co., Cleveland). J. Phys. Chem. 63, 1110-12(1959) July.

The solubility of cerium in cerium trichloride is 9.3 mole % with a temperature coefficient of nearly zero between 777 and 950°C. The solubility of $CeCl_3$ in cerium is not greater than 0.2 mole % at 950°C. Above 777°C and 9.3 mole % added cerium the system consists of two immiscible liquids in equilibrium and has a consolute temperature that is too high to estimate from these data. The data from thermal and chemical analysis reported are consistent with e.m.f. measurements on the system reported previously. (auth)

17899

SOLUBILITY OF NOBLE GASES IN MOLTEN FLUORIDES. II. IN THE LiF–NaF–KF EUTECTIC MIXTURE. M. Blander, W. R. Grimes, N. V. Smith, and G. M. Watson (Oak Ridge National Lab., Tenn.). J. Phys. Chem. 63, 1164-7(1959) July.

Solubilities of He, Ne, and Ar were measured at pressures from 1 to 2 atmospheres in a mixture of LiF, NaF, and KF (46.5-11.5-42.0 mole %) at 600, 700, and 800°C. The solubilities increase linearly with gas pressure, decrease with increasing atomic weight (radius) of the solute, and increase with increasing temperature. Henry's law constants in moles of solute (cm^3 of solution)(atmosphere) at 600°C are $11.3 \pm 0.7 \times 10^{-8}$, $4.36 \pm 0.20 \times 10^{-8}$, and $0.90 \pm 0.04 \times 10^{-8}$ and the enthalpies of solution are 8.0, 8.9, and 12.4 kcal/mole for He, Ne, and Ar, respectively. A model which equates the free energy of solution of the gas to the free energy of formation of holes the size of the gas molecules in a continuous fluid having the same surface tension at the solvent yields solubility values which are in good agreement with those observed. (auth)

17900

THE DISSOCIATION PRESSURE OF ALUMINUM CARBIDE. David J. Meschi and Alan W. Searcy (Univ. of California, Berkeley). J. Phys. Chem. 63, 1175-8(1959) July.

The vapor pressure of Al_4C_3 has been measured in the region from 1500 to 1800°K by means of the Knudsen effusion method and of a torsion method. ΔH^0 at 1600°K was calculated for the reaction $Al_4C_3(s) \rightarrow 4Al(g) + 3C(s)$ by means of the second law and the third law, and respective values of 89 (±3) kcal/mole Al and 87 (±3) kcal/mole Al were obtained. The results indicate carbon content of no more than 2% in the vapor when aluminum carbide is dissociated at 1600°K. (auth)

17901

THE HEATS OF VAPORIZATION OF PARA-HYDROGEN AND ORTHO-DEUTERIUM FROM THEIR BOILING POINTS TO THEIR CRITICAL TEMPERATURES. David White, Jih-Heng Hu, and Herrick L. Johnston (Ohio State Univ., Columbus). J. Phys. Chem. 63, 1181-3 (1959) July.

The heats of vaporization of hydrogen and deuterium have been measured from their boiling points to their critical points. The heats of vaporization of hydrogen deuteride and tritium have been predicted from the data, using a simple mass relationship. (auth)

17902

THE SOLUBILITY OF TANTALUM AND COBALT IN SODIUM BY ACTIVATION ANALYSIS. J. A. Grand, R. A. Baus, A. D. Bogard, D. D. Williams, L. B. Lockhart, Jr., and R. R. Miller (Naval Research Lab., Washington, D. C.). J. Phys. Chem. 63, 1192-4(1959) July.

The solubilities of tantalum and cobalt were determined by equilibrating sodium in tantalum and cobalt vessels at three temperatures. The sodium was irradiated in the Materials Testing Reactor. The solubility values were determined from a separation and counting of active isotopes in the sodium metal. Tantalum solubility ranged from 0.032 to 2.9 parts per million from 325 to 525°C. The range on cobalt was from 0.28 to 0.1 part per million from 365 to 525°C. (auth)

17903

ON THE APPLICATION OF FLUIDIZATION IN THE ISOTOPIC EXCHANGE CONTACT REACTION HD +

$H_2O_{vapor} \rightleftharpoons H_2 + HDO_{vapor}$. A. Selecki (Warsaw Univ.). Nukleonika 3, 661-72(1958). (In Polish)

The effects of a fluidized catalyst in the exchange reaction $HD + H_2O_{vapor} \rightleftharpoons H_2 + HDO_{vapor}$ are described. Because the heat of reaction in isotopic exchange is small, the thermal properties of the fluidized bed are not important in the process. However, the use of finely powdered catalysts and technical measures preventing mixing may facilitate an increase in the output of the process in the case where the reaction is carried out in the region of external or internal diffusion. (auth)

17904

BASIC STUDIES ON ACTIVATION ANALYSIS. I. OPTIMUM SAMPLE POSITION IN ACTIVATION ANALYSIS USING Ra–Be NEUTRON SOURCE IN PARAFFIN MODERATOR. Fumio Aoki and Minoru Okada. Tokyo Kôgyô Shikensho Hokoku 54, 121-5(1959) Apr. (In Japanese)

Optimum distance for a specified experimental condition is reported together with the effect of the orientation of sample surface on induced activity. The optimum distance was determined on three samples (Ag, Rh, V) by use of a Ra-Be neutron source placed in a paraffin moderator. It was found that these samples were most effectively activated by the slow neutron when they were placed 1.7 ± 0.1cm below the bottom of a cylindrical Ra-Be neutron source which was surrounded by a paraffin layer of more than 11cm thickness. As these elements used are considerably different in regard to the total neutron-cross-section spectrum (cross-section vs. energy), the observed optimum distance seems to apply to many other elements. (auth)

17905

MOLECULAR FORCE FIELDS. PART 17. THE GENERAL FORCE FIELD OF SOME HEXAFLUORIDES. J. W. Linnett and C. J. S. M. Simpson (Queen's College, Oxford). Trans. Faraday Soc. 55, 857-66(1959) June.

The regular octahedral molecules have six fundamental vibration frequencies, but their general potential function requires seven independent constants. The possible values and interdependence of seven constants for a general function of the valence-force-field type has been examined for SF_6, SeF_6, TeF_6, MoF_6, WF_6, and UF_6 using the six vibration frequencies of each. By reasonable arguments it has been possible to propose more limited ranges for the possible values of the various constants. The meaning of the values of the constants are presented and their significance discussed in relation to the electronic structures of the various molecules. (auth)

17906

INVESTIGATION OF ACTIVATOR DISTRIBUTION IN NaI–Tl CRYSTALS. B. O. Belikovich, V. N. Vishnevskii, O. B. Liskovich, and M. S. Pidzirailo. Ukrain. Fiz. Zhur. 4, 108-15(1959) Jan.-Feb. (In Ukrainian)

Sodium iodide crystals, thallium activated, were grown from a melt by a modification of Kyropoulos's method. Along with the regulated lateral heater, the furnace contained an independently regulated bottom heater. Crystals about 40 mm in diameter and length were taken for concentration investigations. The thallium concentration in various regions of the grown crystals was determined by the strength of optical absorption at the maximum of the long-wave absorption band of the activator. The activator content of the crystals proved to be 7 to 12 times less than that of the charge. Thallium is distributed somewhat unevenly through the crystal volume: the later the crystal region is formed in the growth process, the lower the thallium content. The longitudinal and radial concentration gradients do not, in general, exceed 10%/cm. In some crystal zones the activator distribution is practically uniform in the radial direction. The latter fact evidently indicates that on applying a regulated bottom heater in the crystal growing furnace, such thermal conditions may be created that the crystal growth front acquires the most advantageous form from the standpoint of uniformity of activator distribution in the crystal. The presence of a relatively small concentration gradient in the investigated crystals indicates that almost the entire effective volume of the crystals grown by the applied method may be utilized as a scintillator. (auth)

17907

CONTRIBUTION TO THE CHEMISTRY OF THE ELEMENTS NIOBIUM AND TANTALUM. XXI. PREPARATIVE STUDIES WITH SECONDARY NIOBIUM CHLORIDES. Harald Schäfer and Kurt-Dietrich Dohmann (Universität, Münster, Ger.). Z. anorg. u. allgem. Chem. 300, 1-32(1959) May. (In German)

The system niobium–chlorine has been investigated. The formation of niobium trichloride, with a composition range from $NbCl_{2.67}$ to $NbCl_{3.1}$, has been studied by thermal decomposition of niobium tetrachloride, reduction of $NbCl_5$ with hydrogen, and the chemical transport reaction: $NbCl_{x(s)} + (4 - x)\ NbCl_{5(g)} = (5 - x)\ NbCl_{4(g)}$. The thermal and chemical properties of the niobium trichloride phase are described. Niobium(II) chloride which is a stoichiometric compound is formed in the reactions $Nb + NbCl_{2.67}$, $Nb + NbCl_5$, and $NbCl_5 + H_2$. There is no evidence for the existence of niobium(I) chloride. (auth)

17908

PREPARATION AND PROPERTIES OF TERNARY NITRIDES OF VANADIUM, NIOBIUM, AND TANTALUM OF THE COMPOSITION Li_7MeN_4. Robert Juza, Wilhelm Gieren and Jurgen Haug (Christian-Albrechts-Universität, Kiel). Z. anorg. u. allgem. Chem. 300, 61-71(1959) May. (In German)

The compound Li_7VN_4 containing vanadium(V) has been prepared by heating Li_3N and VN in nitrogen atmosphere to a temperature of 680°C. Li_7VN_4 crystallizes in a superstructure of fluorite lattice (space group T_d^4 with $a = 9.60_4$ A). Similarly, the compounds Li_7NbN_4 and Li_7TaN_4 have been synthesized. (auth)

17909

DIFFUSION OF Xe-133 IN URANIUM OXIDES WITH DIFFERENT OXYGEN CONTENTS. R. Lindner and Hj. Matzke (Technischen Hochschule, Göteborg). Z. Naturforsch. 14a, 582-4(1959) May-June. (In German)

An experimental method and apparatus are described in detail. Samples of uranium oxide irradiated in a reactor were placed in a quartz tube in a furnace and heated. The I^{131} was separated from the evolved fission product gases by a silver-wool trap and counted using a G–M tube. Data are given which indicate diffusion rate versus temperature for various U/O ratios and show the dependence of Xe^{133} diffusion on the U/O ratio in the oxide. (T.R.H.)

17910

PHOTOMETRIC DETERMINATION OF MICRO-QUANTITIES OF THORIUM. I. E. Starik, F. E. Starik, and K. F. Lazarev (V. G. Khlopin Inst. of Radium, Academy

of Sciences, Leningrad). Zhur. Anal. Khim. 14, 306-12 (1959) May-June. (In Russian)

Optimum conditions have been found for the photometric determination of thorium with Thoron using a photocolorimeter. A method has been developed for separating microgram quantities of thorium from uranium, iron, and other interfering elements by thorium precipitation with calcium oxalate from a weakly acid medium. A method for the determination of thorium in the presence of cerium and lanthanum has been suggested based on the different absorption of colored complexes of these elements with thoron depending on the acidity of the solution. The mean absolute error of the determination of 1–10 μg of thorium is ±0.3 μg. The maximum absolute error does not exceed ±0.5 μg. (auth)

17911

RECORDING OF THE OXYGEN ISOTOPE RATIO IN CARBON OXIDE. M. S. Chupakhin (V. I. Vernadsky Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, USSR, Moscow). Zhur. Anal. Khim. 14, 331-5(1959) May-June. (In Russian)

The design of an ion receptacle intended for the simultaneous recording of 28 and 30 masses and a glass device for the filling system which serves for storing the CO analyzed and filling the mass spectrometer with it is described. A method is presented for the precision recording of the oxygen isotope ratio in carbon oxide and a method for the determination of the absolute O^{16}/O^{18} ratio based on the use of S^{32}/S^{34} = 22,200 ratio from troilite of an iron meteorite as a standard. (auth)

17912

SPECTROPHOTOMETRIC DETERMINATION OF MAGNESIUM IN URANIUM. N. N. Krot, A. P. Smirnov-Averin and A. G. Kozlov. Zhur. Anal. Khim. 14, 352-5(1959) May-June. (In Russian)

A method is described for the spectrophotometric determination of small amounts of magnesium in uranium by means of Eriochrome Black T. The composition of a colored compound of magnesium with Eriochrome Black T has been studied. (auth)

17913

DETECTION AND DETERMINATION OF RHENIUM. A. I. Lazarev (Akmolinsk Agricultural Inst.) Zhur. Anal. Khim. 14, 362-4(1959) May-June. (In Russian)

A new reaction for rhenium has been developed. Conditions for the qualitative and quantitative determination of rhenium have been established. It has been shown that rhenium in the rhenium-sulfite complex is tetravalent and that the colored part is an anion. (auth)

17914

WATER AND HEAVY WATER HEAT OF MIXING. V. P. Skipov (Ural Polytechnic Inst. Sverdlovsk). Zhur. Eksptl'. i Teoret. Fiz. 35, 1294-5(1958) Nov. (In Russian)

The chemical interactions between the molecules of water and heavy water ($H_2O + D_2O \rightleftharpoons 2\,HDO$) are analyzed, and the heat of mixing of the H_2O and D_2O (99.7%) was determined. (R.V.J.)

17915

ON THE MAGNETIC PROPERTIES OF OXIDES OF GADOLINIUM. K. P. Belov, M. A. Zaitseva and A. V. Ped'ko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1672-9(1959) June. (In Russian)

The temperature dependence of the magnetic properties of gadolinium ferrites with garnet and perovskite structures and also of gadolinium manganate was measured. It is found that at the compensation point and the Curie point there is an anomalous growth of the coercive force and a very small paraprocess in garnet ferrite. There is also an anomaly in the behavior of the temperature dependence of magnetostriction The perovskite gadolinium ferrite possesses a weak ferromagnetism of the hematite type. After heating of the sample in a field above the Curie point the magnitude of this ferromagnetism increases. Gadolinium manganate has paramagnetic properties, but in the region of helium temperatures magnetic hysteresis phenomena are observed. (auth)

17916

CHEMICAL PROCESSING OF NUCLEAR FUELS. F. S. Martin and G. L. Miles. New York, Academic Press Inc., 1958. 247p.

The volume is primarily concerned with the problems of chemical processing of nuclear fuel after it has been irradiated in a reactor. Emphasis has been placed on the basic principles of nuclear fuel processing rather than on the technology. The volume is divided into five parts which include: nuclear considerations, aqueous processes, non-aqueous processes, effluent disposal and fission product recovery, and trends in nuclear fuel processing. (W.L.H.)

17917

IMPROVEMENTS IN OR RELATING TO CONTINUOUS PROCESSES OF FORMING BERYLLIUM FLUORIDE. Carl Willy Schwenzfeier, Jr. (to Brush Beryllium Co.). British Patent 814,929. June 17, 1959.

Apparatus and a continuous process for producing BeF_2 from NH_4BeF_3 are described. In the process NH_4BeF_3 is fed to a furnace or reactor at high temperature in which decomposition occurs, the NH_4F vapor being drawn off at the top and molten BeF_2 being removed at the bottom. The fan which sweeps the NH_4F out by drawing in air through leaks in the furnace maintains a slightly negative pressure in the apparatus keeping noxious fumes from escaping. The NH_4F is passed into a water absorber where it is recovered. Any NH_4F passing unrecovered through the absorber is collected in an electrostatic precipitator. (T.R.H.)

17918

PRODUCTION OF ZIRCONIUM TETRACHLORIDE. (to Metal & Thermit Corp.). British Patent 815,245. June 24, 1959.

Production of $ZrCl_4$ from zircon sand by reaction with sulfur–chlorine vapor at 1000 to 1200°C is described. The zircon sand may first be fritted with Na_2CO_3 at 900°C to form Na_2ZrSiO_5 which is then reacted with the S–Cl mixture. The heated S–Cl mixture is passed over the zircon sand. The exit gases are first passed through a warm condenser (150 to 200°C) where $ZrCl_4$ collects, then through a cold condenser and another very cold condenser (dry ice–acetone) to collect the other products. Apparatus for the reaction and its operation are described. (T.R.H.)

17919

METHOD OF PRODUCING ZIRCONIUM OXIDE FROM ZIRCONIUM TETRACHLORIDE. Wilhelm Brugger (to Th. Goldschmidt Aktiengesellschaft). British Patent 815,425. June 24, 1959.

A method is described for producing ZrO_2 in solid form by reaction of $ZrCl_4$ with H_2O vapor or alcohol vapor at 220 to 240°C. Calcination of the hydrate thus formed at 1000 to 1100°C produces ZrO_2 of high bulk density. The $ZrCl_4$ can be treated with steam for 1 to

1.5 hr at 220°C then calcined at 1000°C for 2 to 3 hrs, or it can be treated with steam 1 hr at 220°C then raised to 500 or 550° for 0.5 hrs followed by calcination at 1000°C for 2 hrs. Alternatively, the $ZrCl_4$ can be treated with CH_3OH vapor for 5 hours at 280°C, then the reaction is completed with superheated steam in about 30 min. The reaction is done in a rotating vessel. (T.R.H.)

17920

IMPROVED SILICA GLASS AND PROCESS FOR ITS MANUFACTURE. (to Quartz & Silice). British Patent 816,412. July 15, 1959.

A process is given for making a very pure silica glass which retains its transparency in the visible spectrum after prolonged irradiation by UV, x, α, β, and γ rays and neutrons. The glass contains only a very small amount (0.001) of Ce and other materials which produce radioactive isotopes under some types of radiation. A very pure SiO_2 charge must be used. The Ce is added by decomposing a Ce salt with NH_3 and melting under non-oxidizing conditions. This glass, irradiated to saturation in a flux of 10^{13} neutrons/sec, had a radioactivity less than 300 mc/g. (T.R.H.)

17921

METHOD FOR TREATING FLUORIDES BY SUBLIMATION AND APPARATUS FOR THE WORKING THEREOF. (to Centre d'Etudes pour les Applications de l'Énergie Nucleaire). British Patent 816,620 July 15, 1959.

An apparatus for sublimation of fluorides is described which can be used for a variety of fluorides. The device, which is arranged to operate near 0.001 mm and up to 1000°C, has a condensing plate the temperature of which can be regulated by positioning a water-cooled plate at the distance corresponding to the desired temperature. Graphite plates are fixed in the apparatus with holes ~0.5 mm diam. inclined 70° with respect to the axis of the cylindrical vessel. The fluoride vapor acquires a helical or swirling motion as it moves upward through these holes. Thus impurities in the vapor are brought against the walls and deposited in circular or helical grooves there. (T.R.H.)

Radiation and Radiochemistry

17922 AAEC/E-33

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

PRODUCTION OF HIGH SPECIFIC ACTIVITY COBALT-60 IN HIFAR. J. S. Watt. Feb. 1959. 8p.

High specific activity cobalt-60 sources as used in teletherapy work, may be produced in HIFAR. Approximate calculations indicate that a specific activity of 30 curies per gram per year can be made in the 2V and 6V experimental holes, and that a total activity of 21,000 curies per year in these holes corresponds to using 1% excess k. (auth)

17923 AERE-R-2881

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REMOVAL OF RADIOACTIVE IODINE AND STRONTIUM FROM MILK BY ION EXCHANGE. P. Cosslett and R. E. Watts. Apr. 1959. 12p. $0.35 (BIS).

Up to 98% of the iodine-136 present in the milk of a cow dosed with radioactive iodine has been removed by passing the milk through a column of a strong base anion exchanger in the chloride form. The milk remained palatable. Experiments on the removal of calcium and added strontium from milk indicate the possibility of removing up to 98% of any radiostrontium in milk. The strontium may be removed by a strong acid cation exchanger in the calcium form. (auth)

17924 CNI-13

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

SEPARATION OF CARRIER-FREE Y^{90} FROM Sr^{90}. C. Lepscky and G. Restelli. May 1959. 5p.

A simple apparatus for obtaining carrier-free and high-purity Y^{90} from Sr^{90} retained on a cation exchange column, has been designed. Purity of Y^{90} has been checked, and a purification factor of 9×10^6 was obtained. (auth)

17925 USNRDL-TR-342

Naval Radiological Defense Lab., San Francisco.

STABILITY OF RADICALS PRODUCED BY IRRADIATION. T. H. Anderson and R. S. Alger. July 6, 1959. 14p.

The concentration of free radicals in methanol at −196°C produced by electron bombardment cannot go above ½ mole % because the back reaction speeds up and the species crowd close enough to react with each other. These cage effects show up as the temperature goes up or down. (auth)

17926 CEA-tr-R-672

DÉTERMINATION DU NOMBRE D'ATOMES DE CARBONE DANS UNE MOLÉCULE ORGANIQUE PAR LA MÉTHODE RADIOCHIMIQUE. (Determination of the Number of Atoms of Carbon in an Organic Molecule by the Radiochemical Method.) I. A. Korshunov and N. F. Novotorov. Translated into French by B. Vinogradoff from Zhur. Obshchei Khim. 28, 47-50 (1958). 8p.

The possibility of using a counter tube for the radiochemical determination of radioactive carbonic acid and organic compounds, which have a vapor pressure not less than 4 to 5 mm of mercury, is shown. The labeled compound can be used simultaneously as the quenching agent. The comparison of activities measured on C^{14}-labeled compounds in the gaseous form, then as carbonic acid from the combustion of the compound, allows a determination of the total number of carbon atoms in the molecule and a determination of the fraction of radioactive atoms in the same molecule. The impurity content of the organic compound can be quantitatively evaluated. (tr-auth)

17927 CEA-tr-R-674

SÉPARATION DE L'URANIUM ET DU VANADIUM. (Separation of Uranium and Vanadium.) Yu. (Iu.) V. Morachevskii (Moratchevsky), A. I. Belyaeva (Beliaeva), and L. V. Ivanova. Translated into French from Zhur. Anal. Khim. 13, 570-5(1958). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 1209.

17928

PREPARATION OF RADIOCHEMICALLY PURE Np^{239} USING FISSION PRODUCT RECOIL. Yu. A. Zolotov and I. P. Alimarin. Atomnaya Energ. 6, 70-1(1959) Jan. (In Russian)

Radiochemically pure Np^{239} was prepared by separating the parent element from active fission fragments. The recovery was achieved by crushing uranium dioxide

and screening the fraction of particles precipitated at the rate of $\leq 2.16 \times 10^{-3}$ cm/sec. The mean diameter of the separated particles, in agreement with Stokes' law, was $\sim 2\mu$. The suspended concentration was weighed, and an aliquot was diluted to saturation with calcium nitrate. After mixing with concentrated ammonium carbonate solution, the potassium carbonate was precipitated, filtered, washed, dried, and weighed. The ratio $UO_2 : CaCO_3$ fluctuated from 1 : 100 to 1 : 500. The mixture was irradiated in a neutron flux of 7×10^{12} neutron/cm^2 sec for 12 to 48 hours. The irradiated material was washed, dissolved, oxidized to the hexavalent state using $KBrO_3$, extracted into ether, and reextracted into hydrazine chloride. The purity of recovered Np^{239} was checked by decay. The decay curve did not vary during 24 days. Recovery by the above method can be achieved in 1 to 2 hours; moreover, the separation of active fission fragments takes place during the initial few minutes. The method is an extension of that of R. Wolfgang (J. Inorg. & Nuclear Chem. 2, 180(1956)). (R.V.J.)

17929

EFFECTS OF RADIATION ON THE VALENCE STATE OF Pu IN PERCHLORIC ACID SOLUTIONS. N. I. Popov. Atomnaya Energ. 6, 71-3(1959) Jan. (In Russian)

A lanthanum fluoride method was used for separating plutonium in various valence states into oxidized and reduced groups. The "retaining oxidants" used in previous experiments were not used in order to avoid secondary reactions. Irradiation effects on the valence states in 0.3 N $HClO_4$ are plotted. The general plutonium concentration was $\sim 10^{-4}$ mole/l. A graphic presentation is given of the radioinduced changes in the valence states of plutonium in 0.3 N $HClO_4$ + 0.03 M $UO_2(ClO_4)_2$ solutions with various ratios of oxidized and reduced forms. The dependence of the initial plutonium reduction reaction yield on the concentration of $UO_2(ClO_4)_2$ in various solutions of 0.3 N $HClO_4$ and on the concentration of oxidized plutonium in the solution of 0.3 N $HClO_4$ + 0.01 M $UO_2(ClO_4)_2$ were analyzed. Plutonium reduction by radiation is tabulated in relation to the concentration of $UO_2(ClO_4)_2$. (R.V.J.)

17930

RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS OF ORGANIC HALOGEN DERIVATIVES. I. RADIOLYSIS OF AN AQUEOUS CHLOROFORM SOLUTION. J. Teplý (Militärtechnische Akademie "Antonín Zápotocký," Brno). Collection Czechoslov. Chem. Communs. 24, 1933-42(1959) June. (In German)

In the investigation of the radiolysis of aqueous chloroform solutions, the radiation yield of hydrogen chloride and its dependence on the speed of the energy absorption, the chloroform concentration, and the temperature were determined under various conditions. The effect of dissolved oxygen was studied, and the mechanism of the chloroform degradation and the kinetics of the induction period were treated critically. (tr-auth)

17931

HYPERFINE STRUCTURE OF THE ELECTRON RESONANCE SIGNALS OF IRRADIATED GLYCOCOLL. Roger Servant, Claude Augoyard, and Nguyen Ngoc Chau. Compt. rend. 249, 71-3(1959) July 6. (In French)

The modification of the electron magnetic resonance of glycocoll irradiated by gamma rays is reported. At low temperatures the quintet hfs is transformed to quartet. (tr-auth)

17932

THE EFFECT OF γ-RADIATION FROM Co^{60} ON HYDRATED NITRATE CRYSTALS. A. S. Baberkin (Karpov Research Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 126, 591-3(1959) May 21. (In Russian)

The effects of dosage on the radiochemical transformation yield from hydrated nitrate crystals of 2+ cations were studied with nitrates of calcium, cadmium, zinc, and magnesium irradiated by γ rays from a Co^{60} source with doses from 0.2×10^{16} to 4.1×10^{16} ev/ml sec. It is shown that the initial nitrite yield does not depend on the dose; however, with the increase of integral dose a well expressed dependence on dosage was observed for each salt. The initial nitrite yields at 7×10^{19} ev/g for $Ca(NO_3)_2 \cdot 4H_2O$, $Cd(NO_3)_2 \cdot 4H_2O$, $Zn(NO_3)_2 \cdot 6H_2O$, $Zn(NO_3)_2 \cdot 6H_2O$, and $Mg(NO_3)_2 \cdot 6H_2O$ are tabulated. A comparison of nitrite yield from anhydrous salts and hydrated crystals shows that the latter are more sensitive to γ radiation. (R.V.J.)

17933

X-RAY STUDY OF ARTIFICIAL RARE-EARTH COMPOUNDS OF THE $TRNbO_4$ TYPE. A. I. Komkov (All-Union Research Inst. of Geology). Doklady Akad. Nauk S.S.S.R. 126, 853-4(1959) June 1. (In Russian)

The crystalline structures of $TRNbO_4$ (TR is La, Ce, Pr, etc.) were analyzed to determine if the rare elements form continuous isostructural series or form replacement series with morphotropic changes in crystalline structure analogous to tungstates and molybdates. The structural bonds between these complexes and fergusonite mineral group (Y, TR) (Nb, Ta)O_4 were also investigated. $TRNbO_4$ complexes with the TR^{3+} rare earth cations Ce, Dy, Er, Gd, La, Nd, Pr, Sm, and Yb were synthesized by mixing equal quantities of TR_2O and Nb_2O_5 in an oxygen–hydrogen furnace and in an arc furnace. The x-ray investigation showed a continuous isostructural series. In the course of diminishing La^{3+} and Yb^{3+} ionic radii, a regular diminishing of the elementary cell in $LaNbO_4$ and $YbNbO_4$ takes place. The elementary cell parameters of the complexes are tabulated. (R.V.J.)

17934

CHEMICAL ASPECTS OF THE PREPARATION AND USE OF ARTIFICIAL RADIOELEMENTS. C. Fisher (Commissariat a l'Énergie Atomique, Paris). Énergie nucléaire 1, 105-8(1959) May-June. (In French)

A study was made of: processes for production of artificial radioelements; different chemical methods for carrier-free separation starting with the irradiated material; the possibilities which the sensitivity of detection of radioelements offers to trace chemistry; the chemical effects of radiation and nuclear reactions. These studies emphasize two characteristic principles of the chemistry of artificial radioelements: the very small quantities of material used and the importance of the energies absorbed or liberated in the course of radioactive processes. (tr-auth)

17935

INDUSTRIAL PROSPECTS FOR RADIATION CHEMISTRY. Jean-René Puig (CEN, Saclay France). Inds. atomiques 3, No. 5-6, 53-62(1959). (In French)

The various industrial means of producing radiation and the interactions of various radiations with matter are discussed. The application of radiation chemistry to macromolecular systems in industry is discussed with respect to polymerization of monomers, irradia-

tion of plastics (polyethylene) to improve properties, and graft copolymer synthesis. Radiation chemistry of polyphenyls, CO_2, and air is included because of their roles as reactor coolants and moderators. The present trend in industrial radiation chemistry is toward applications in heterogeneous catalysis and direct use of fission energy. (T.R.H.)

17936

ON THE SOLVENT ISOTOPE EFFECT OF DEUTERIUM IN AQUEOUS ACID SOLUTIONS. E. Lee Purlee (Florida State Univ., Tallahassee). J. Am. Chem. Soc. 81, 263-72(1959) Jan. 20.

The Gross-Butler theory for the solvent isotope effect of deuterium on acid-catalyzed reaction rates in D_2O-H_2O mixtures is re-examined. New values for the thermodynamic activity function, Q'(n), for proton and deuteron at 25° are derived from experimental data by using the correct value for the isotopic exchange equilibrium constant for D_2O-H_2O and by taking into account the apparent difference in free energy between (Cl^-) in D_2O and (Cl^-) in H_2O. An independent check of the Q'(n)-function at 25° is obtained by applying the rule of the geometric mean to the distribution of hydrogen isotopes between lyonium ion and water. Values for the thermodynamic activity function, Q'(n) are calculated for application at temperatures other than 25°, and it is demonstrated that equilibrium constants and reaction rates observed at 0, 15, 18, 30, and 35° are well predicted by the Gross-Butler theory when values of the Q'(n)-function corresponding to the appropriate temperatures are used. The nature of deviations from the Gross-Butler rate equation is briefly discussed. It is noted that the acid-catalyzed inversion of sucrose and the acid-catalyzed hydrolysis of methyl acetate and ethyl formate show significant deviations from the theory. The complete failure of the Gross-Butler rate equation to predict the rates for the acid-catalyzed mutarotation of glucose indicates that this reaction does not proceed via a pre-equilibrium mechanism. (auth)

17937

IRRADIATION OF POLYETHYLENE. III. INFLUENCE OF TEMPERATURE AND PHASE. T. F. Williams and Malcolm Dole (Northwestern Univ., Evanston, Ill.). J. Am. Chem. Soc. 81, 2919-26(1959) June 20.

Gamma-ray irradiation of the linear polyethylene, Marlex-50, above the melting point yields a higher evolution of hydrogen and a greater degree of cross-linking and of vinylene double bond production than irradiation at room temperature. The infrared band at 10.1 μ is missing in the case of the 142°C irradiated polyethylene, and the crystallization ability is reduced. Vinyl and vinylene double bond decay constants are increased at the upper temperature, but not markedly so. G values for vinylene decay in the case of Marlex-50 containing 5% of trans-1,4-poly-(butadiene) are as high as 50.6 groups decayed per 100 ev of energy absorbed in the whole sample, but gel formation remains unchanged, leading to the postulate of vinylene decay in this mixture by intramolecular coupling. Material balance between hydrogen evolution, crosslinking and double bond formation is approached in the case of Marlex-50 at both 25 and 142°C by allowing for a calculated increase in the weight average molecular weight due to endlinking. It is concluded that both M_n and $\overline{M}_w$ increase by the factor $[Vi]^0/[Vi]$ as endlinking occurs. Material balance is not achieved in the case of a low density polyethylene. At the gel point of the latter the decrease in vinylidene unsaturation is estimated to be almost four times as great as cross-links produced, a fact which suggests that vinylidene groups are located near the ends of the molecules. A post-irradiation fusion of vacuum irradiated Marlex-50 causes a greater vinyl decay, increased vinylene group formation a greater G value for crosslinking. These facts suggest strongly that crosslinking can occur by rearrangement of segments containing free radicals as well as by C–C bond formation during the radiolytic detachment of hydrogen. The trans-1,4-poly-(butadiene) lowers $G(H_2)$ and G(–Vi) at 142°C, but the latter more than the former; cis-1,4-poly-(butadiene) has a smaller effect. At room temperature the protective action of the poly-(butadiene) seems to be much less, probably because of non-uniform mixing in the solid state. (auth)

17938

EFFECTS OF u.v. AND γ RADIATIONS ON SOLUTIONS OF ACRIDINE. IV. CONTRIBUTION TO THE KINETIC STUDY OF THE PHOTOCHEMICAL REACTION OF ACRIDINE IN ALCOHOL. Arlette Kellmann (Faculté des Sciences, Paris). J. chim. phys. 56, 574-7(1959) June. (In French)

A kinetic study was made of the photochemical reaction of acridine in alcohol at 3660 A. The quantum yield of the product obtained was determined varying the temperature, luminous intensity, and concentration. The product was obtained also by irradiation at 2500 A and by γ radiation. Moreover the formation of the product was also observed in other hydrogeneous solvents such as hexane and benzene. (tr-auth)

17939

CHEMICAL EFFECTS IN FISSION RECOIL. IV. THE EFFICIENCY OF RECOILING ATOMS IN THE DECOMPOSITION OF POTASSIUM NITRATE. D. Hall and G. N. Walton (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 10, 215-24(1959) May.

Previous experiments on the decomposition of potassium nitrate by fission fragments recoiling from uranium foils have been repeated using thin films of uranium oxide enriched in U^{235}. Fragments recoiling from very thin layers are found to be about 2.7 times more efficient in causing decomposition than fragments recoiling from an effectively infinitely thick source. Measurements on the decomposition caused by fragments emerging from aluminum absorbers show that at the ends of the tracks the yield per 100 ev of ionizing energy is more than the average for the whole track, but that the yield per 100 ev of total energy does not appear to change appreciably. The average G factor for the decomposition has been redetermined as 6.0 nitrite ions per 100 ev of recoil energy absorbed. (auth)

17940

SZILARD-CHALMERS EFFECT OF SLOW NEUTRON CAPTURE IN SELENIUM DIOXIDE. D. M. Pinkerton and J. H. Green (Univ. of New South Wales, Kensington, Australia). J. Inorg. & Nuclear Chem. 10, 334-5(1959) May.

Selenium dioxide was purified, irradiated, and chemically treated. The red selenium metal was filtered off and treated with barium chloride. The value of the percentage of Se^{75} which was separable with red selenium carrier was 0.51 ± 0.07. Results show a definite yield of Se^{75} in lower-valence forms after slow neutron activation of solid selenium dioxide. (C.J.G.)

17941
TRITIUM-LABELLED ORGANIC IMPURITIES IN ^{3}He. J. K. Lee and F. S. Rowland (Univ. of Kansas, Lawrence). J. Inorg. & Nuclear Chem. 10, 336-7(1959) May.

Tritium is found chemically bound as hydrogen gas, methane, ethane, propane, isobutane, n-butane, and traces of higher hydrocarbons as an impurity in commercial He^3. The amounts of activity in each state are tabulated. Removal of the radioactive contaminants is discussed. (C.J.G.)

17942
POLYMERIZATION OF METHYL METHACRYLATE INDUCED BY GAMMA IRRADIATED POLYMETHYL METHACRYLATE. Stanley M. Hirshfield and Leigh C. Anderson (Univ. of Michigan, Ann Arbor). J. Polymer Sci. 37, 542-3(1959) June.

A transparent gel was produced in two weeks' time from a mixture of methyl methacrylate and polymethyl methacrylate which had been irradiated for 24 hours using a 5000 curie Co^{60} source. (C.J.G.)

17943
γ-IRRADIATION OF POLYVINYL CHLORIDE IN WATER. Kenichi Shinohara and Toshiaki Takamatsu. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 29-35(1959) June.

Polyvinyl chloride was irradiated in water by gamma rays from cobalt-60, and the results of measurements of its viscosity are compared with those obtained by irradiation in air and vacuum. Measurements on melting temperature and gel formation were also carried out. It is shown that cross-linked polymers resulted by the absorption of a comparatively small dose in water. Chemical analysis carried out on the irradiated samples revealed G-value of about 25 for the evolution of chlorine atoms when irradiated in water, which may be compared with the value of 5.4 obtained for the irradiation in air by electrons. The results cannot be explained by the simple exclusion of oxygen by the surrounding water but may be interpreted as showing the existence of indirect actions from the water which is promoting cross-linking. (auth)

17944
STUDIES ON CHEMICAL CHANGE IN RADIOLYSIS. I. THE ACTION OF GAMMA RAYS ON TWO-PHASE SYSTEM OF CHLOROBENZENE-WATER. Masao Matsui. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 82-9(1959) June.

In general, organic halogen compounds are easily affected by the action of ionizing radiation owing to their so-called radiosensitivity in a high degree, and they set free HX. Therefore, it is possible to measure the dose by the amount of HX. (auth)

17945
STUDIES ON CHEMICAL CHANGE IN RADIOLYSIS. II. THE ACTION OF GAMMA RAYS ON TWO-PHASE SYSTEM OF CHLOROBENZENE-WATER. Masao Matsui. Sci. Papers Inst. Phys. Chem. Research (Tokyo) 53, 90-7(1959) June.

The chlorobenzene-water system has been studied as to the characteristic required for dosimetry and found practicable within the limits of 4.5×10^6 to 1.34×10^8 r. (auth)

17946
SOME APPLICATION POSSIBILITIES OF MICROWAVE SPECTROSCOPY IN QUANTITATIVE RADIATION BIOLOGY. Adolf Müller and Karl G. Zimmer (Reaktorstation, Karlsruhe, Ger.). Strahlentherapie 109, 192-9 (1959) June-July. (In German)

Possible applications of microwave spectroscopy in the field of radiation biology are reviewed. (C.H.)

17947
PROCEEDINGS OF THE SYMPOSIUM ON ADVANCES IN TRACER APPLICATIONS OF TRITIUM, NEW YORK CITY, OCTOBER 31, 1958. Boston, New England Nuclear Corp., 1959. 69p.

Applications of tritium in tracer studies are discussed. The preparation of tritiated compounds is discussed. Uses of tritium in autoradiography, applications in the assay of steroids in biological extracts, applications in studies of metabolism, and applications as a tracer in industrial research are described. New methods for counting tritium are reported. Ionization chambers, scintillation detectors, and proportional counters are described and illustrated which were developed for counting tritium. (C.H.)

17948
IRRADIATION OF HYDROCARBONS. (to Esso Research and Engineering Co.). British Patent 814,562. June 10, 1959.

The properties of normal paraffins may be improved or changed by the irradiation process described. A normal paraffin such as cetane is irradiated by fast neutrons at temperatures from 0 to 800°C and pressures from 0 to 100 atm. to produce higher boiling materials. An inorganic material (catalyst) is dispersed in the hydrocarbon before irradiation; materials suitable for this are alumina, silica-alumina, Pt on alumina, boria on alumina, and boria on silica-alumina. The products obtained for irradiation of cetane plus silica-alumina and cetane plus platinum on alumina are given. (T.R.H.)

17949
IMPROVEMENTS IN METHODS OF CROSS-LINKING OR VULCANIZING SYNTHETIC RESINS OR RUBBERS BY MEANS OF IONIZING RADIATIONS. (to Centre National de la Recherche Scientifique). British Patent 816,791. July 22, 1959.

The irradiation in the absence of oxygen of synthetic resins or rubbers to cause cross-linking or vulcanization is described. The irradiation should be done without oxygen to improve the properties of the product. The results of various treatments of polyethylene are given to show the efficacy of out-gassing before irradiation. (T.R.H.)

Separation Processes for Pu and U

17950 CF-59-7-25
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE PROGRAM: COMMENTS BY FMPC, DATED JULY 6, 1959, ON EUROCHEMIC TECHNICAL DOCUMENTS. F. L. Cuthbert. July 14, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

Comments made by FMPC personnel on Eurochemic technical documents are given. (T.R.H.)

17951 CRDC-822
Atomic Energy of Canada Ltd., Chalk River, Ont.
A REVIEW OF THE CHEMICAL ASPECTS OF AQUEOUS PROCESSING. R. G. Hart. July 1959. 41p. (AECL-853). $1.00(AECL).

The chemical aspects of processing various fuel element types by solvent extraction with tributyl phosphate are described. Fuel element types considered are

Al-clad U, Al-clad UO_2, Zircaloy-clad UO_2, Al-clad Th, Al-clad ThO_2, and Al- and Zircaloy-clad Al–Pu alloys. Decladding, dissolution, separation, and purification are considered in detail. Irradiation and decay considerations, decontamination requirements, and reagent stability are also discussed. (D.E.B.)

17952 HW-49633(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DEJACKETING OF ZIRCALOY CLAD FUEL ELEMENTS WITH AMMONIUM FLUORIDE SOLUTIONS. Interim Progress Report. J. L. Swanson. Apr. 15, 1957. Decl. with deletions June 24, 1959. 24p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

Experimental work is reviewed on the chemical decladding procedures using aqueous ammonium fluoride solutions as a dissolving medium for removing Zircaloy-2 jackets from reactor fuels. (J.E.D.)

17953 IDO-14467
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
IDAHO CHEMICAL PROCESSING PLANT TECHNICAL PROGRESS REPORT FOR OCTOBER THROUGH DECEMBER 1958. C. E. Stevenson. May 19, 1959. 39p. Contract AT(10-1)-205. $1.00(OTS).

In studies of process criticality problems, it was estimated that reactivity might be added at a rate of perhaps one percent ΔK-second by jetting a uranium-235 solution into a large vessel. Aging a ruthenium-bearing feed improved its decontaminability by Hexone. Studies of dibutyl phosphate compounds indicated that uranium and aluminum compounds were similar in solubility relationships, and differed in that respect from a zirconium compound. Small concentrations of DBP markedly increased the extraction of zirconium, particularly under acid-deficient conditions. Lead appears to be a potentially useful construction material for dissolving zirconium in nitric-hydrofluoric acid mixtures, provided sulfate is also present. Stainless steels, Hastelloy F, and Incoloy 804 are corroded seriously by nitric-hydrofluoric mixtures. A ceramic alumina may be useful. The effect of acid on zirconium fluoride precipitation is similar in nitrate and chloride systems. TBP in dodecane extracts hydrogen fluoride moderately well from aqueous solutions. Trioctyl phosphine oxide extracted over 90 percent of the zirconium from a nitrate solution at a fluoride ratio of 2:1 in multiple treatments. Successful tests were made of canned rotor pumps with oversize and with flame-plated alumina bearings. Exploratory testing of a bubble flowmeter was made. A special silica gel tested for adsorbing ruthenium from nitrate decomposition gases shows little or no decrepitation. Operation of the NaK heating system for the pilot plant calciner is summarized, and a solids sampling system has been developed for this equipment. A gravity system to recirculate venturi scrub solution was tested. Formaldehyde has been used to remove nitric acid from chrome-nickel-iron solutions and to convert aluminum nitrate solution to a strongly basic form. An analytical technique was developed to determine very small amounts of phosphate in kerosene. (For preceding period see IDO-14457.) (auth)

17954 NP-7681
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
DESIGN OF PLANT FOR TREATING IRRADIATED NUCLEAR FUELS: PRELIMINARY OPERATING FLOWSHEETS. Technical Report No. 25. Lung, [E.] Hoffmann, [O.] Jenne, [E.] Detilleux, [A.] Redon, and [M.] Zifferero. Nov. 30, 1958. 28p. $6.30(ph), $3.00(mf) OTS.

The Purex Process was chosen for the Eurochemic Plant. Flowsheets and material balance sheets are given for the plant. (W.L.H.)

17955 NP-7782
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
MATERIAL BALANCE. Technical Report No. 50, Chapter 150. E. Detilleux, E. L. Nicholson, A. Redon, and M. Zifferero. [nd]. 17p. $3.30(ph), $2.40(mf) OTS.

The material balance was calculated from the chemical flowsheets on the basis of 647 kg of U processed per day. No special material balance was calculated for the dejacketing-dissolving process. The required decontamination and separation factors are tabulated for the extraction step. (W.L.H.)

17956 NYO-2700
New York Operations Office. Nuclear Materials Management Branch, AEC.
CONFERENCE ON RECOVERY OF ENRICHED URANIUM SCRAP HELD AT NEW YORK, SEPTEMBER 23-24, 1958. 115p. $2.75(OTS).

The recovery of enriched U scrap at the Electromagnetic Separation Plant (Y-12) is discussed. The criticality aspects of the recovery of enriched U scrap are presented. The recovery of low assay enriched U is described. Discussions are also presented on the handling of radioactive wastes. (W.L.H.)

17957 RDB(W)/8142
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
COLLECTED PARTITION DATA FOR TRI-BUTYL PHOSPHATE. N. R. Geary. Aug. 1955. 58p.

All partition data related to TBP in aliphatic hydrocarbon solution which might be of use to workers in the field of solvent extraction process development are presented. The need to make the information quickly available to these teams has precluded, except in two cases, the application of mathematical tests of consistency. In consequence, both graphic and tabular presentation have been used, the former providing an indication of the reliability of the results, as well as charts for quick reference. Comment by the present author has been kept to a minimum consistent with ease of use. (auth)

17958 RDB(W)/TN-16
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
AN AUTOMATIC INDICATION OF THE EFFICIENCY OF THE REDUCTION STAGE OF THE PRIMARY SEPARATION PLANT. W. F. Fullwood and F. R. Harris. Feb. 4, 1952. 17p.

It is highly desirable that the efficiency of the reduction of the plutonium prior to, and in Column II of the primary separation plant should be indicated by some form of metering device, so as to show immediately any tendency of the plutonium to pass out with the butex stream. The possibility of such a device was investigated. (auth)

17959 RDB(W)/TN-165
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England.
THE DEVELOPMENT OF A MIXER-SETTLER FOR

SLAG RECOVERY PROCESSES. L. Lowes and J. A. Williams. Oct. 1954. 59p. (RB/R-85).

A 14-stage stainless steel mixer-settler based on K.A.P.L. developmental work is described. This apparatus is considered suitable for Pu slag recovery processes, and a similar design may be applied to the process for the recovery of U from slags. The apparatus can be developed for use under highly active conditions by the application of extended impeller shafts or flexible transmission cable with keyed-in impeller housings. (J.R.D.)

17960

COMBINED USE OF URANIUM ORES. B. V. Nevskii. Atomnaya Energ. 6, 5-13(1959) Jan. (In Russian)

Descriptions are given of uranium recovery from uranium-bearing copper, gold, niobium–tantalum, pyrite, and zirconium ores and of various methods of complex extractions. (R.V.J.)

17961

SOME ECONOMIC QUESTIONS CONCERNING THE TREATMENT OF URANIUM ORES. Josef Kortus (Chemoprojekt, Prague). Jaderná energie 5, 84-91 (1959). (In Czech.)

A survey is given of some Geneva reports with the aim to make the reader acquainted with the most important economic questions concerning uranium ore treatment. The development of the uranium price on the world market, the costs of mining, treatment and processing of uranium ores, and some economic questions of the production of pure uranium are discussed. In conclusion there is mention of the location of the plants for uranium ore treatment and the problems of rendering the radioactive wastes harmless. (auth)

CONTROLLED THERMONUCLEAR PROCESSES

17962 AERE-R-2955

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THERMAL SHOCK AND THERMAL STRESS FATIGUE IN A STABILISED PINCH FUSION REACTOR. R. A. Dugdale. June 1959. 18p. $0.42(BIS).

The expected mode of operation of a fusion reactor employing the stabilized pinch is outlined. A guess is made that the energy produced per cm length per pulse will be about 1 megajoule. The form the energy takes and its dissipation in the reaction chamber wall is discussed. An estimate of the temperature difference developed across a wall under simplified conditions and the resultant stresses and strains set up is given. These are used together with the present knowledge in the fields of thermal shock and thermal stress fatigue to estimate the conditions to produce cracking of the wall. Some metals appear to be superior to ceramics in these respects. It is concluded that thermal shock and thermal fatigue will impose limitations on the mode of operation and the dimensions of a reactor and that there is a need for research in these fields. (auth)

17963 LAMS-2333

Los Alamos Scientific Lab., N. Mex.

QUARTERLY STATUS REPORT OF THE LASL PLASMA THERMOCOUPLE DEVELOPMENT PROGRAM FOR PERIOD ENDING JUNE 20, 1959. Samuel Glasstone, comp. and ed. July 1959. 15p. Contract W-7405-eng-36. $0.50(OTS).

The in-pile test assembly is described, and the results of the test of the plasma thermocouple cell are given. A new type of plasma thermocouple cell was designed. Brief reports are given of other equipment, neutronics studies, and studies of carbides and carbide systems. (T.R.H.)

17964 NYO-6376

Princeton Univ., N. J. Project Matterhorn.

TIME CONSTANTS FOR SOLID CIRCULAR COILS OF RECTANGULAR CROSS SECTION. Technical Memorandum No. 31. Richard M. Rosen. Sept. 1956. 13p. $3.30(ph), $2.40(mf) OTS.

Time constants were calculated for solid circular coils. Diagrams of coil dimensions are presented, and sources of formulas are cited. The constants are tabulated. (J.R.D.)

17965

PLASMA HEATING BY OSCILLATING MAGNETIC FIELD. P. Baruch (Ecole Normale Supérieure, Paris). Énergie nucléaire 1, 94-100(1959) May-June. (In French)

Processes envisaged for heating completely ionized plasma consist of furnishing energy to one of the components (ions or electrons) and equipartition of this energy by collisions (electron-electron, ion-ion, and ion-electron). It is shown that the Joule effect which imparts energy to electrons (the heating is obtained by ion-electron collisions) is incapable of very high temperatures. There is much interest in giving the energy directly to the ions. Four interesting methods for this excitation are considered: gyrorelaxation—on which little practical experimentation has been done; magnetic pumping—an efficient process, but it still has not been used successfully; acoustic heating (shock waves)—experiments have given promising results; and the cyclotron resonance of ions—the existence of which has been proved. The latter seems to be the most effective means for heating plasma, even though experiments have not been undertaken. (tr-auth)

17966

ALTERNATIVE NEUTRAL BURNOUT EQUATION. Albert Simon (Oak Ridge National Lab., Tenn.). Phys. Fluids 2, 336-7(1959) May-June.

An alternative method of calculating the burnout condition of a thermonuclear plasma which takes explicit account of self-shielding is given. (C.J.G.)

17967

ON THE INERTIAL-ELECTROSTATIC CONFINEMENT OF A PLASMA. William C. Elmore, James L. Tuck, and Kenneth M. Watson (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids 2, 239-46(1959) May-June.

A system in which electrons are projected radially inwards from a spherical surface has been proposed for the confinement of a plasma at thermonuclear temperatures. The equilibrium, economics, and stability of such a system are discussed theoretically. Although it is of doubtful utility as a thermonuclear reactor, it may be possible to produce in this way small regions of thermonuclear plasma for study. The device appears to be unstable at economic densities. The stability is discussed in terms of a virial, which turns out to be mathematically tractable in this geometry. (auth)

17968

FIELD MIXING AND ASSOCIATED NEUTRON PRODUCTION IN A PLASMA. A. C. Kolb and C. B. Dobbie

(Naval Research Lab., Washington, D. C.) and H. R. Griem (Univ. of Maryland, College Park and Naval Research Lab., Washington, D. C.). Phys. Rev. Letters 3, 5-7(1959) July 1.

A series of experiments was performed to determine the magnitude of the internal electric fields in a preheated deuterium plasma with a trapped internal axial magnetic field, which is compressed by a large externally generated axial field. (W.D.M.)

17969

INJECTION INTO THERMONUCLEAR MACHINES USING BEAMS OF NEUTRAL DEUTERIUM ATOMS IN THE RANGE FROM 100 kev TO 1 Mev. G. Gibson, W. A. S. Lamb, and E. J. Lauer (Univ. of California, Livermore). Phys. Rev. 114, 937-40(1959) May 15.

Injection into a steady magnetic mirror machine by ionization of a beam of neutral deuterium atoms is analyzed. If the neutral beam is switched on in a sufficiently good vacuum, then the trapped plasma density will build up to a steady-state value of interest for experimental study. (auth)

CRITICALITY STUDIES

17970 AECD-4285

Los Alamos Scientific Lab., N. Mex.

A URANIUM CRITICAL ASSEMBLY AT LOW U^{235} CONCENTRATION. G. A. Linenberger. [1956]. Decl. June 1, 1956. 14p. Contract [W-7405-eng-36]. $3.30 (ph), $2.40(mf) OTS.

A critical metal assembly is described that has a cylindrical core of uranium with an average U^{235} concentration of 16¼% and a 3 inch reflector of natural uranium. The critical mass was determined to be 692 ± 4 kg of core material, from which a value for the critical mass of a bare sphere, having the same concentration, is calculated. Measurements of the prompt neutron decay constant, reactivity contributions of several materials, and radial and axial variations of fission rates of U^{235}, U^{238}, and Np^{237}, as well as ratios of fission cross sections for these isotopes, are reported. (auth)

17971 CF-59-2-78

Oak Ridge National Lab., Tenn.

ANALYSIS OF NEUTRON PULSES IN A GODIVA-TYPE REACTOR. C. W. Nestor and Melvin Tobias. Feb. 25, 1959. 16p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Some calculations have been made to estimate the characteristics of a neutron-burst type fast reactor similar to Godiva but made up of relatively small component parts—the so-called "layered assembly." One spherical and three cylindrical assemblies have been considered. Critical masses, assuming 5% voids, range from 58 to 65 kg of 93.4% enriched U^{235}. For a reactivity addition of 0.33 dollars above prompt critical, bursts between 2×10^{17} and 6.7×10^{17} fissions were computed with accompanying temperature rises varying from 514 to 1600°C. The burst width at half-maximum was about 12 microseconds. To obtain an idea of the possibilities of stress reduction which might be achieved by layering, an assembly made of small rings was considered. While the critical masses obtained here are believed to be fairly accurate, the predictions concerning mechanical energy generated, total fissions, and burst width may be subject to sizeable error due to the many simplifications required to allow hand computations. Nevertheless, considerable improvement in safety and burst-size is indicated by the use of a "layered assembly" instead of an assembly composed of relatively thick parts. (auth)

17972 FZM-1807

Convair, Fort Worth, Tex.

A DIGITAL COMPUTER CODE FOR REACTOR HAZARDS ANALYSIS. J. C. Couchman. June 15, 1959. 18p.

Paper presented at the Summer Meeting of the American Nuclear Society, Gatlinburg, Tennessee, June 15-17, 1959.

To facilitate reactor-hazards predictions, numerical operations were programmed for the IBM-704 digital computer. (W.L.H.)

17973 NDA-84-23(Rev.1)

Nuclear Development Corp. of America, White Plains, N. Y.

CONCEPTUAL DESIGN OF A NATURAL URANIUM, D_2O-MODERATED CRITICAL FACILITY. M. Bernstein, R. Hankel, and R. Schamberger. July 1, 1959. 38p. Project No. II. Contract AT(30-1)-2303. $7.80 (ph), $3.30(mf) OTS.

The conceptual design of a full-scale, natural U, D_2O-moderated critical experiment is presented. The objectives of this program are: to investigate and evaluate possible natural-U D_2O-moderated critical experiment programs and select that which will supply the maximum amount of new information to the technology of natural-U D_2O-moderated reactors, to develop a conceptual design of a critical facility which will meet the requirements of the program developed in, and to prepare preliminary cost estimates for the design, construction, and operation of the critical facility. (W.L.H.)

17974 TID-3533

Technical Information Service Extension, AEC.

CRITICALITY STUDIES. A Literature Search. Raymond L. Scott, comp. Aug. 1959. 117p. $2.50 (OTS).

A compilation of 1122 references on criticality studies is presented including references to experimental and theoretical studies of conditions for criticality with various materials and configurations, as well as references on the safe handling of fissionable materials, both during critical experiments and in plants for the chemical and metallurgical processing of fissionable materials. (W.D.M.)

GEOLOGY AND MINERALOGY

17975 JEN-49

Spain. Junta de Energia Nuclear, Madrid.

ESTUDIO DE MINERALES RADIACTIVOS ESPAÑOLES. I. FOSFATOS DOBLES DE URANIO–CALCIO Y DE URANIO–COBRE DE VENTA DE CARDEÑA (CORDOBA). (Study of Spanish Radioactive Minerals. I. Double Phosphates of Uranium–Calcium and Uranium–Copper of Venta de Cardeña (Cordova).) R. Fernández Cellini, T. Batuecas Rodriguez, and J. Vera Palomino. 1959. 21p.

The ore deposits of Venta de Cardeña were studied to determine their chemical composition and to make mineralogical identification. The radioactive minerals are constituted of double phosphates of uranium and calcium and of uranium and copper. The calcium uranium double phosphate is metaautunite I with the for-

mula $Ca(UO_2)_2(PO_4)_2 \cdot 6.40H_2O$. The copper uranium double phosphate is torbernite with the formula $Cu(UO_2)_2(PO_4)_2 \cdot 10.6H_2O$. From studies of the Debye-Scherrer powder diagrams of both the yellow component and the bluish green component of the minerals, it was determined that they belong to the tetragonal system. Radiochemical studies indicate that the components have not attained radioequilibrium and that the matrix is enriched in radioactivity. (tr-auth)

17976 RME-2040

Grand Junction Operations Office. Salt Lake Branch Office, AEC.

AIRBORNE RECONNAISSANCE IN THE VALLEY OF FIRE-MUDDY MOUNTAINS REGION, NEVADA. Donald C. Barrett and Neil Mallory. Sept. 1955. 14p. $0.50 (OTS).

The Valley of Fire-Muddy Mountains region, located 20 to 30 miles northeast of Las Vegas, Nevada, was given approximately 25 percent airborne radiometric coverage during the fall of 1954. Rocks in the area range from Cambrian to Miocene in age. Uranium was known to occur at two sedimentary horizons at the time the airborne program began. One new uranium-bearing sedimentary horizon was discovered by the airborne reconnaissance. Of 15 anomalies detected, only 11 were posted as the remainder were claimed at the time of the survey. (auth)

17977 TID-8201

Division of Raw Materials, AEC.

AN ANALYSIS OF THE CURRENT AND LONG-TERM AVAILABILITY OF URANIUM AND THORIUM RAW MATERIALS FOR ATOMIC ENERGY DEVELOPMENT. July 1959. 8p. $0.50 (OTS).

Current and long-term availability of U and Th raw materials is reviewed. Reserves and potential annual production of U are several times those of Th at current prices; however, at some presumably higher price, Th might approach that of U. (J.R.D.)

17978 AEC-tr-3738

RADIOMETRIC METHODS IN THE PROSPECTING AND EXPLORATION OF URANIUM ORES. (Radiometricheskie Metody Poiskov i Razvedki Uranovykh Rud.) V. V. Alekseev, A. G. Grammakov, A. I. Nikonov, and G. P. Tafeev. Translated from a Publication of the State Scientific-Technical Publishers of Literature on Geology and Mineral Resources Conservation, Moscow, 1957.

Issued in two books: (Bk. 1), 344p. and (Bk. 2), 303p. $6.00 (OTS).

Part one of this volume discusses the physical and geological principles of the methods of radiometric prospecting. Methods of measurement and instruments are the subjects of part two. In part three search and prospecting methods are presented. Part four deals with the complex application of geophysical methods and the factors determining their efficiency in the search and prospecting for U ore deposits. (W.L.H.)

17979 NP-tr-253

THE CONTENT OF MICROELEMENTS IN CERTAIN SOILS DEVELOPED ON ORE-BEARING ROCKS. D. P. Malyuga and A. I. Makarova. Translated by A. Schoenfeld (U.K.A.E.A., Atomic Energy Research Establishment) from Pochvovedenie, No. 1, 50-3 (1956). 7p. $1.80 (ph), $1.80 (mf) JCL or LC. (Figure Omitted).

Data obtained from a study of the soils of the Aktyubinsk ore district, the Autonomous Region of Tuva, and East Transbaikal are presented. The majority of the analyses was done spectroscopically; results are listed in terms of wt. %. (J.R.D.)

17980

HAIWEEITE, A NEW URANIUM MINERAL FROM CALIFORNIA. T. C. McBurney (Smith-Emery Co., Los Angeles) and Joseph Murdoch (Univ. of California, Los Angeles). Am. Mineralogist 44, 839-43 (1959) July-Aug.

A hydrous calcium uranium silicate, found near the Haiwee Reservoir in the Coso Mountains, California, has been determined as a new mineral and named haiweeite, from the locality. It occurs as spherulitic aggregates, or single flake-like grains, on fracture surfaces in granite and in voids of the adjacent lake bed deposits. It is pale yellow to greenish yellow in color; hardness 3.5; specific gravity 3.35; luster pearly. A chemical analysis gives it the following formula: $CaO \cdot 2UO_3 \cdot 6SiO_2 \cdot 5H_2O$. Optically it is biaxial negative, with 2V about 15°; the acute bisectrix is nearly normal to the broad surface of the blade-like grains {100}. Dispersion is strong, with $r \rightarrow \nu$. The spherules from the granite are in general made up of two components, of which the inner has higher indices of refraction, and may be considered to be meta-haiweeite. The outer shell is made up of haiweeite, with indices α 1.571, β 1.575, γ 1.578. X-ray study of minute flakes shows that the mineral is monoclinic(?) with the following (approximate) cell-dimensions: $a_0 = 15.4$ Å, $b_0 = 7.05$ Å, $c_0 = 7.10$ Å, $\beta = 107°52'$. Space is probably $P2/c - C_{2h}^4$. (auth)

17981

URANIUM OCCURRENCE IN RHINELAND-PFALZ. Friedrich Schwille (Geologisches Landesamt Rheinland-Pflaz, Mainz). Atomwirtschaft 4, 235-41 (1959) June. (In German)

The discovery of a uranium deposit near Ellweiler is discussed. The preliminary prospection results and the economic significance of the occurrence are reviewed. The uranium content is about 60 to 80 tons at a percentage of 0.11 to 0.12%. (J.S.R.)

17982

URANIUM AND THORIUM POSSIBILITIES IN TURKEY. Melih Tokay and Cahit Erentöz. Bull. Mineral Research Exploration Inst. Turkey. Foreign Ed. No. 52, 80-99 (1959) Apr.

The formations and districts which are likely to bear uranium and thorium in Turkey are discussed. In view of the great demand for uranium during the last few years, intensive and comprehensive surveys have been conducted in the world, whereby it has been proven that certain formations show more favourable conditions and hence are more promising in so far as uranium and thorium are concerned. Based on various publications, on the visits made in the largest uranium mines both in the U. S. A. and France, and in the light of the data obtained from surveys conducted during the last few years, particularly by the Mineral Research and Exploration Institute of Turkey (M.T.A.), it has been possible to make a comparative study and establish the districts in Turkey promising in uranium and thorium. (auth)

17983

RADIOACTIVITY AND THE AGE OF THE EARTH. Rene Coppens (Université, Nancy, France). Inds. atomiques 3, No. 5-6, 37-52 (1959). (In French)

Methods of determining the age of the earth are compared briefly, and the radiometric method is then treated in detail. The various radiogeochronologic methods described are: total Pb, Pb-α, Pb isotopes, K-Ar, Rb-Sr, C^{14}, T, He, and the pleochroic halo

method. These methods give the ages of rocks and the ages of the rocks give the age of the earth's crust. The age of element formation is also calculated. (T.R.H.)

17984

DIELECTRIC CONSTANT AND ELECTRICAL RESISTIVITY OF NATURAL-STATE CORES. G. V. Keller and P. H. Licastro. U. S. Geol. Survey Bull. 1052-H. 1959. 32p. $0.20.

As part of a program to obtain basic data on the physical properties of the rock in and near uranium-mineralized zones, measurements of electrical resistivity and dielectric constant were made on parts of 27 cores from the Morrison formation in the Colorado Plateau uranium province. For frequencies between 50 cycles and 30 megacycles per second, resistivity ranged from 10^2 to 10^{12} ohm-centimeters, and the dielectric constant ranged from 4.0 to 10^6. The water content of the cores seemed to be the controlling factor: the high resistivities were associated with low water content and the high dielectric constants with high water content. (auth)

17985

AREAL GEOLOGY OF THE PLACERVILLE QUADRANGLE, SAN MIGUEL COUNTY, COLORADO. A. L. Bush, C. S. Bromfield, and C. T. Pierson. U. S. Geol. Survey Bull. 1072-E. 1959. 88p., 3 illus.

The Placerville quadrangle includes an area of about 59 square miles in eastern San Miguel County in southwestern Colorado. It is within and adjacent to the northeastern boundary of the Colorado Plateaus physiographic province. The precipitous front of the San Juan Mountains lies only 3 miles to the east. The quadrangle includes features characteristic of both the plateaus and the mountains, and has been affected by geological events and processes of two different geologic environments. Within the Placerville quadrangle, and in the Little Cone quadrangle to the south and the Gray Head quadrangle to the southeast, the Entrada sandstone of Late Jurassic age contains vanadium deposits. These deposits form an essentially continuous layer 9 to 10 miles long and 1 to $1\frac{1}{2}$ miles wide. Associated with the vanadium is a small but significant percentage of uranium. The occurrence of these deposits in close proximity to the intrusive and extrusive rocks and base- and precious-metal deposits of the San Juan Mountains affords an unusual opportunity to study the relations between the various types of deposits and the igneous province. Accordingly an area of about 300 square miles is being studied and mapped in detail. This large area, comprised of the Placerville, Little Cone, Gray Head, Dolores Peak, and Mount Wilson quadrangles, includes the sedimentary rocks and vanadium-uranium deposits characteristic of the Colorado Plateau and the Tertiary extrusives, stocks, sills, dikes, and vein deposits characteristic of the San Juan igneous province. The present report describes the areal geology of the Placerville quadrangle. (auth)

17986

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 4SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-198. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1959. $0.50.

17987

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 4 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-199. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1959. $0.50.

17988

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 1 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-200. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1959. $0.50.

17989

PHOSPHATE DEPOSITS IN NORTHERN ALASKA. EXPLORATION OF NAVAL PETROLEUM RESERVE NO. 4 AND ADJACENT AREAS, NORTHERN ALASKA, 1944-53. PART 4. REGIONAL STUDIES. William W. Patton, Jr. and John J. Matzko. U. S. Geol. Survey Profess. Paper 302-A. 1959. 20p., 4 illus. $1.00.

Deposits of sedimentary phosphate rocks are found on the Arctic Slope of Alaska and occur in at least two stratigraphic units, the Lisburne group and the Shublik formation, and have been found at widely scattered localities along the north front of the Brooks Range and in adjoining foot hills. Samples of phosphate rocks containing as much as 35.8% P_2O_5 have been found in the Shublik formation. Plates, maps, and diagrams are given. (J.E.D.)

17990

TABLES FOR THE CALCULATION OF LEAD ISOTOPE AGES. SHORTER CONTRIBUTIONS TO GENERAL GEOLOGY. L. R. Stieff, T. W. Stern, Seiki Oshiro, and F. E. Senftle. U. S. Geol. Survey Profess. Paper 334-A. 1959. 44p. $0.35.

Tables are presented for calculating geologic age by using the atomic ratios of Pb^{206}/U^{238}, Pb^{207}/U^{235}, Pb^{207}/Pb^{206}, and Pb^{208}/Th^{232}. Tables of values of N_d/N_p and t are given for the age equation $N_d/N_p = \exp\lambda t - 1$, where λ is the decay constant, t is age, in millions of years, N_d is the number of atoms of daughter products, and N_p is the number of atoms of parent. Values for N_{207}/N_{206} and t are also given in tabular form for the age equation $(N_{207}/N_{206}) = [\exp\lambda_{235}t - 1/k(\exp\lambda_{238}t - 1)]$ where N_{207} and N_{206} are the number of atoms of radiogenic Pb^{207} and Pb^{206}, respectively, and where k, the present day atomic ratio of U^{238} to U^{235}, is taken as 137.7. The half lives (T) of U^{238}, U^{235}, and Th^{232} used in the calculations are: $T_{238} = 4.51 \times 10^9$ years, $T_{235} = 7.13 \times 10^8$ years, $T_{232} = 1.42 \times 10^{10}$ years. The tables cover selected values of t from 1 to 6,000 million years (6×10^9 years) at intervals of t ranging from 1 to 15 million years. Only the calculated errors in t resulting from experimental uncertainties in the determinations of the decay constants and relative abundance of U^{238} and U^{235} have been included. An example is given for the hypothetical geologic age calculation by use of these tables. (auth)

17991

METHOD OF ORE TREATMENT. (to United Kingdom Atomic Energy Authority). British Patent 815,081. June 17, 1959.

A method of recovering U from ore and converting it to oxide is given. In one example of the process 50 g of pulverized carnotite plus 100 ml of 1:1 HNO_3 are digested at 100°C for 30 min, then evaporated to dryness. Four 50-ml ethyl ether extractions are made. The ether extract is then extracted with 3 2-ml portions of water which will contain some U and should be saved. The ether soln. of $UO_2(NO_3)_2$ can then be dried and ignited, or the $UO_2(NO_3)_2$ can be extracted into 3 or 4 20-ml portions of H_2O and dried and ignited. (T.R.H.)

HEALTH AND SAFETY

17992 AFSWP-99

Armed Forces Special Weapons Project, Washington, D. C.

DOSAGE AND DOSE-RATE CURVES OF RESIDUAL RADIOACTIVITY BASED ON MULTIPLE DECAY OF GROSS FISSION PRODUCTS AND RADIATION INTENSITY CHARTS FOR RADIUM COBALT 60 CALIBRATION SOURCES. Sept. 1952. 24p. (AD-94391).

Three graphs are presented for use in estimating radiological dosages, dose rates, and length of time personnel may remain in a contaminated area without exceeding specified radiation dosages. The calibration of radiation detection instruments is discussed. (C.H.)

17993 ARDC-TR-58-51

George Washington Univ., Washington, D. C.

PROCEEDINGS OF TRI-SERVICE CONFERENCE ON BIOLOGICAL HAZARDS OF MICROWAVE RADIATION, JULY 15-16, 1957. Evan G. Pattishall, comp. and ed. Sept. 1957. 128p. Project No. 57-13. Contract AF18(600)-1180. (AD-115603).

Results are presented of research on the biological hazards of microwave radiation. Limits for microwave tolerance were established at a level of 10 milliwatts/cm^2 for a significant portion of the microwave spectrum. Recommendations are presented for future research. (C.H.)

17994 BLG-34

Brussels. Centre d'Etude de l'Energie Nucléaire.

SUR LA RETOMBEE DU STRONTIUM-90. (Fall-Out of Strontium-90.) A. Terzaghi and E. Van der Stricht. Apr. 6, 1959. 34p.

The theories concerning fall-out mechanisms of test debris are briefly considered. The contribution of the delayed fall-out to the total fall-out is calculated by applying the Kuroda formulas to the measurements made at Mol, Belgium. The relationship between the amount of rainfall and the amount of fall-out is also investigated, and results are reported. (auth)

17995 HASL-65

New York Operations Office. Health and Safety Lab., AEC.

STRONTIUM PROGRAM QUARTERLY SUMMARY REPORT. Edward P. Hardy, Jr., and Stanley Klein. May 29, 1959. 204p. $3.50(OTS)

Levels of strontium-90 in fall-out, milk, air, water, vegetation, foods, and bone are given, based on data available from February 1, 1959 to May 20, 1959. In addition, dietary strontium-90 estimates are given for the United States and are used to predict the future content of human bone. Burst dates for publicly announced weapon tests and annual yields, which were presented during the Congressional Hearings on Fall-out from Weapons Tests before the Joint Committee on Atomic Energy (May 5 to 8, 1959), are listed. A bibliography of published reports lists material related to fall-out and the strontium program. (For preceding period see HASL-55.) (auth)

17996 KAPL-A-RP-2

Knolls Atomic Power Lab., Schenectady, N. Y.

S3G RADIATION PROTECTION TRAINING GUIDE. K. E. Fritz and F. W. Richardson, comps. July 1959. 119p. Contract W-31-109-Eng-52. $19.80(ph), $6.30(mf) OTS.

This manual was prepared as a basic reference and training guide on radiation protection for personnel of Knolls Atomic Power Laboratory and United States Navy located at the S3G test facility at West Milton, New York. The S3G is the prototype of the nuclear propulsion plant for the submarine TRITON. The objectives and functions of the Radiation Protection group are summarized and radiation hazards and control measures used at the facility are discussed. (auth)

17997 NP-7753

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

SITING IN RELATION TO NORMAL REACTOR OPERATION AND ACCIDENT CONDITIONS. F. R. Farmer and P. T. Fletcher. June 17, 1959. 22p.

Normal operations of a plant and the radiations arising are discussed. Conditions leading to accidents both in the plant and due to site and weather conditions are presented. Different levels of exposure are evaluated as to excessive doses. The levels discussed are inhalation, consumption of exposed foodstuffs, milk restriction, and whole-body radiation from ground and cloud. Hazard ranges are given for fission product release of iodine-131 and strontium-90 under certain weather conditions. Desired action to minimize the effects of radiation from the various levels is discussed. Effect of population distribution on site selection is described. (C.J.G.)

17998 RISLEY-5006/31

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

EQUIPMENT USED IN THE BACKGROUND RADIOACTIVITY SURVEY OF THE WINDSCALE AREA. G. E. Buckley. Mar. 3, 1950. 8p.

Details are presented of the equipment which is being used to determine the background radioactivity in the Windscale Area. The survey vans, gamma background measuring equipment, the beta counting equipment, inactive dust particle size and concentration equipment, and Health Physics Center Control Room are described. (auth)

17999 SCTM-83-58(51)

Sandia Corp., Albuquerque, N. Mex.

MICROMETEOROLOGICAL VARIABILITY AND FALLOUT PATTERN ERRORS. H. W. Church. Feb. 1958. 8p. Contract AT(29-1)-789. $1.80(ph), $1.80(mf) OTS.

A general discussion of the problem of a relationship between fall-out and wind variability on small-scale events is stated. Related previous work is indicated, together with suggestions for investigating relationships by micrometeorological instrumentation. (auth)

18000 SCTM-112-59(51)

Sandia Corp., Albuquerque, N. Mex.

COMPARISON OF FALLOUT DOSES FROM NEVADA TESTS. J. W. Reed. Apr. 1959. 10p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

Data summaries from off-site personnel film badges have been compared with exposures recorded by fixed-mount badges and fall-out maps from Operation Plumbbob. Resulting statistics are applied to show actual exposures individuals may receive from living on various fall-out-map dose contours. (auth)

18001 SCTM-129-56(51)

Sandia Corp., Albuquerque, N. Mex.

ALBUQUERQUE WINDS ALOFT IN RELATION TO FALLOUT. C. E. Buell. June 18, 1956. 14p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

Winds aloft data indicate that in autumn, winter, and

spring, fall-out activity from an atomic explosion in the vicinity of Albuquerque would definitely be carried east from Albuquerque. In the summer, for low yields the fall-out would be carried eastward but with appreciable chance for some significant fall-out occurrence in any direction, while for larger yields the presence of east winds above 50,000 feet indicate the likelihood of fall-out being carried both eastward and westward. (auth)

18002 SCTM-177-57(51)
Sandia Corp., Albuquerque, N. Mex.
A SLIDE-RULE FALLOUT CALCULATOR. Maynard Cowan, Jr. Oct. 1, 1956. 35p. Contract AT(29-1)-789. $6.30(ph), $3.00(mf) OTS.

A slide-rule fall-out calculator has been designed to fulfill a need for a simple, mechanical piece of equipment to be used for estimating radioactive fall-out. The calculator has been tested sufficiently to ensure feasibility of its practical use in the field by both military and civilian agencies. Operational procedures for its use are presented, and a prototype calculator is included as a functional feature of the report. (auth)

18003 TID-5557
Office of Operations Analysis and Forecasting, AEC.
A REVIEW OF INFORMATION ON THE GAMMA ENERGY RADIATION RATE FROM FISSION PRODUCTS, AND ITS SIGNIFICANCE FOR STUDIES OF RADIOACTIVE FALLOUT. Harold A. Knapp. Apr. 24, 1959. 16p. $0.50(OTS).

Presented at the Hearings on Fallout before the Joint Committee on Atomic Energy, May 5-8, 1959.

Available information concerning the gamma photon energy radiation rate from fission products is summarized, and the specific assumptions which now seem most suited for fall-out evaluations are outlined. Determination of the gamma energy radiation rate from fission products is broken down to two separate problems: (1) the relative variation in the energy release rate with time; and (2) the absolute level of the energy release rate at some time from a fixed quantity of fission products. (W.D.M.)

18004 TID-5560
Atomic Energy Commission, Washington, D. C.
THE STATEMENT OF DR. W. F. LIBBY BEFORE SPECIAL SUBCOMMITTEE ON RADIATION, JOINT COMMITTEE ON ATOMIC ENERGY PUBLIC HEARINGS ON THE BIOLOGICAL AND ENVIRONMENTAL EFFECTS OF NUCLEAR WAR. June 18, 1959. 18p. $0.50(OTS).

The effects of radiological warfare on populations are reviewed. It is pointed out that for radiological defense to succeed, it is necessary for people to learn about fall-out and about the effects of nuclear radiation on people, animals, plants, food, and water. In the event of radiological warfare, survival and recovery actions will depend on public knowledge. People must be taught what to do to keep from being killed or injured during radiological warfare. It is the responsibility of the government to encourage technological developments which will improve the effectiveness of defense preparations. A fall-out shelter is essential for a high degree of protection for each family. The shielding afforded by conventional residences is discussed. The design and construction of family and group shelters are described. The need for radiological warning systems is discussed, and two warning systems for individual or family use are described. (C.H.)

18005 TID-5561
Division of Biology and Medicine. Environmental Sciences Branch, AEC.
LONG-TIME ECOLOGICAL EFFECTS OF NUCLEAR WAR. John N. Wolfe. Aug. 1959. 6p. $0.50(OTS).

Presented at the Hearings on the Biological and Environmental Effects of Nuclear War, before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy.

Speculations are presented concerning the long-time ecological effects of nuclear war. (C.H.)

18006 TID-5563
Division of Biology and Medicine. Radiation Effects of Weapons Branch, AEC.
BIOLOGICAL EFFECTS OF A NUCLEAR ATTACK. Gordon M. Dunning. Sept. 1959. 31p. $0.50(OTS).

Presented at the Hearings on the Biological and Environmental Effects of Nuclear War, before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy.

The biological effects on man of a nuclear attack were calculated based on an assumed attack of 1453 megaton total yield on the United States, one-half of the total yield being fission and one-half fusion and all surface bursts. An area having an assumed fall-out of two kiloton per square mile was selected for complete analysis. Both short-term and long-term hazards are summarized. It is pointed out that the dominant hazard from a nuclear attack would be casualties resulting from the blast, heat, immediate nuclear radiation, and early deaths from large radiation doses from the fall-out. Long-term hazards include the production of leukemia and bone tumors by both external gamma exposure and internal emitters, especially those of strontium-90 and cesium-137, life shortening; and genetic effects. Anticipated long-term effects on the population are calculated. (C.H.)

18007 UCRL-5623
California. Univ., Livermore. Lawrence Radiation Lab.
RADIOACTIVITY ASSOCIATED WITH UNDERGROUND NUCLEAR EXPLOSIONS. Roger E. Batzel. June 23, 1959. 14p. Contract W-7405-eng-48. $0.50(OTS).

The detonation of a contained or partially contained nuclear explosion is accompanied by the deposition of a large fraction of the energy in the form of high-temperature, high-pressure regions. The nature of the surrounding medium, the time-temperature history, and the time of cavity collapse or venting determine the extent to which undesirable nuclides such as Sr^{90} and Cs^{137} will appear outside a fused insoluble matrix and be available to ground water or to the atmosphere. The movement of these undesirable radioactivities relative to the ground water movement can be predicted on the basis of measured K_D's (distribution coefficients) for the radioactivities in the medium. The induced radioactivities are a 20 to 25% contribution to the fission product radioactivity at times the order of one day, a 1% contribution at about 1 week, decreasing to 0.1% at about 45 days, increasing to about 2% because of the Co^{60} for a period of 3 to 15 years. (auth)

18008 USNRDL-TR-321
Naval Radiological Defense Lab., San Francisco.
ANALYSIS OF RADIOLOGICAL DECONTAMINATION DATA OBTAINED FROM FIELD TESTS. C. F. Miller. Apr. 3, 1959. 91p.

Reclamation data on ground and buildings contami-

nated with fall-out from Operation PLUMBBOB are used to illustrate a method of treating and analyzing such data obtained in field-test experiments. The method utilizes available radiation-scattering computations to estimate the contribution of radiation sources outside reclaimed areas to the radiation field inside the areas. These contributions are then subtracted to determine a more accurate value of the true effectiveness of the reclamation procedure or procedures. (auth)

18009 USNRDL-TR-344

Naval Radiological Defense Lab., San Francisco. CHANCE OBSERVATIONS OF FALLOUT CLOUD TRANSIT RADIATION AT OPERATION PLUMBBOB. R. L. Mather. Jan. 30, 1959. 20p.

By chance, observations of fall-out cloud transit radiation spectra were observed in the background spectra following a thermonuclear explosion. These observations show that the cloud gamma-ray sources contain prominent lines at 1.3 and 1.5 Mev in the time interval between 18 and 200 minutes after shot time. The expected continuum of scattered gamma-ray energies below these energies is observed. Prominent lines above these energies are absent. (auth)

18010 AEC-tr-3670

SAFETY REGULATIONS FOR WORK WITH RADIOACTIVE SUBSTANCES IN LABORATORIES. Translated from Zdravookhranenie Rossiiskoi Federatsii, No. 3, 35-6(1958). 3p. $1.80(ph), $1.80(mf) JCL or LC.

Safety regulations are presented for the handling of radioactive substances in laboratories. (C.H.)

18011

SKIN ERUPTIONS OF WORKERS IN A URANIUM-PROCESSING PLANT. Roy L. Kile and J. A. Quigley. A.M.A. Arch. Dermatol. 79, 383-9(1959) Apr.

Approximately 175 patients, who were employed at a uranium-processing plant, were observed. The commonest problems were contact dermatitis and dryness of the skin, the latter due to frequent bathing with a detergent type of chemical and to laundering procedures. It was usually controlled by proper lubrication and the use of a superfatted soap. Careful records were kept of radiation and chemical exposures of all employees. No relationship is seen between the amount of exposure and the skin problems. (auth)

18012

EMERGENCY RESPIRATORY PROTECTION AGAINST RADIOLOGICAL AND BIOLOGICAL AEROSOLS. H. Gerald Guyton, Herbert M. Decker, and George T. Anton (Biological Warfare Labs., Fort Detrick, Md.). A.M.A. Arch. Ind. Health 20, 91-5(1959) Aug.

Eighteen variations of eight household and personal items were evaluated with use of human subjects to determine their potential utilization as emergency respiratory protection expedients in the event of a radiological or biological attack. Five variations of these items have a filtration efficiency greater than 85%. They are man's cotton handkerchief folded to a thickness of 16 layers, folded to a thickness of 8 layers, or placed over the mouth in a crumpled state; a commercially available toilet paper, when used in a thickness of three sheets; a bath towel, when folded in two layers. However, the high resistance of the handkerchief when folded to give 16 layers and when crumpled limits the usage of these two variations to short intervals of time. In order to determine if wet items were superior to dry items, five of the cloth materials were evaluated after being saturated with water and subsequently hand-wrung. The most efficient of these items was found to be the bath towel (70.2%). This result is less than that obtained for seven dry items. Four of the five wet items exhibited extremely high resistance to breathing. Therefore, the use of wet items as respiratory protective expedients appears impractical. (auth)

18013

SYNERGISTIC EFFECTS OF AEROSOLS. II. EFFECTS ON RATE OF CLEARANCE FROM THE LUNG. Charles W. LaBelle and Heinrich Berger (Jefferson Medical Coll., Philadelphia). A.M.A. Arch. Ind. Health 20, 100-5(1959) Aug.

The rates at which inhaled foreign particulates are eliminated from the lung after exposure differ widely, the extreme values for the half-life in the lung being one hour for metallic iron particles and five and one-quarter months for beryllium sulfate. A part but not all of this variation is associated with differences in particle size, large particles, in general, being expelled more rapidly than small particles. Particulates reaching the lung in very small amounts may be retained in the lung for unexpectedly long periods. This would likely be true of the particulates present in the general atmosphere as a result of smog or fall-out. Predictions as to the effect of smog or fall-out which are based on analogies with industrial experience may be misleading, since industrial dust levels are commonly adequate to stimulate elimination by phagocyte production. The simultaneous administration of inert dust can accelerate the expulsion of biologically active particles from the lung when the latter are present in very small amounts. The greater lung burden increases the release of phagocytes. Accidental exposures to highly noxious particulates (e.g., radium sulfate aerosol) have occurred in the past and doubtless will occur in the future. More or less effective decontamination procedures have been developed both for internal and for external depots with the exception of the lung itself, where the hazard of such deposition is perhaps the greatest. It is at least conceivable that the synergistic stimulation of phagocytes by inert particles might permit therapeutic decontamination of the lung. (auth)

18014

A NOMOGRAM FOR THE CALCULATION OF THE γ RADIATION FOR A POINT SOURCE. Konrad Sagel (Metallgesellschaft AG., Frankfurt am Main). Atompraxis 5, 229-32(1959) June. (In German)

A description is given of a nomographic method which makes it possible to determine the x-ray dose rate that can be expected at a distance R with any gamma energy. The absorber thickness necessary for the attenuation of x rays of any energy can also be determined by this method. The accuracy of the method is discussed. (auth)

18015

STRUCTURAL WALLS FOR PROTECTION AGAINST NEUTRON BEAMS. (to Simon Missotten). German Patent DAS 1 040 767. Sept. 10, 1958. Atompraxis 5, 248(1959) June. (In German)

Neutrons possess considerable velocity, and therefore a structural protective measure against neutrons depends first on the slowing down and then the absorption of the neutrons. Structural walls are characterized by the inclusion of constituents which slow the neutrons placed near absorbing materials. Materials such as graphite, or beryllium, whose attenuation effects on neutrons are known, should be used as the attenuator. The thickness of the protecting wall could be decreased

with respect to the usual construction and the same protective effects would be obtained.

18016

ENVIRONS MONITORING OF ATOMIC ENERGY PLANTS WITH COUNTER TUBES. H. Kiefer and R. Maushart (Strahlenschutz-Messabteilung der Kernreaktor Bau- und Betriebsgesellschaft m.b.H., Karlsruhe, Ger.). Atomwirtschaft 4, 247-52(1959) June. (In German)

The suitability of counter tubes for the environs monitoring of reactor plants is discussed. The construction and performance of such counters are reviewed with respect to several years' experience at the Karlsruhe research installation. The counting rate of a tube suspended in free air is separated into individual components caused by cosmic radiation and radiation from the air space and from the ground. (J.S.R.)

18017

THE ROLE OF THE BLOOD IN THE TRANSPORTATION OF STRONTIUM^{90}–YTTRIUM^{90} IN TELEOST FISH. Howard Boroughs and Della F. Reid (Univ. of Hawaii, Honolulu). Biol. Bull. 115, 64-73(1958) Aug.

As the result of global fall-out and the introduction of radioactive wastes from nuclear reactor plants into the oceans, marine organisms are being subjected to an environment which is potentially hazardous to themselves and to other members of the ecosystems involved. A study was made of various aspects of the metabolism of radiostrontium by marine fish. These fish may pick up strontium directly from sea water, by way of the skin, gills, or by swallowing the water. They may also take up this element from their food. In any event, the transportation of strontium within the fish, including its excretion, depends upon its transportation by the blood, except for the strontium which is unabsorbed from the digestive tract. A report is presented on certain aspects of the transportation of strontium^{90}–yttrium^{90} in teleost blood. (auth)

18018

ARRANGEMENT OF SANITARY LOOPS IN LABORATORIES AND SHOPS DEALING WITH RADIOACTIVE MATERIALS. Miloš Panýr (Chemoprojekt, Prague). Jaderná energie 5, 161-4(1959). (In Czech.)

The paper gives information about sanitary loops in laboratories and shops dealing with radioactive materials. After the principal data have been given, the classification of loops by categories is described. Suggestions about their extent and also some examples of their arrangements are given. (auth)

18019

A HIGH INTENSITY COBALT CONTAINER FOR INDUSTRIAL RADIOGRAPHY. Metallurgia 59, 311-12 (1959) June.

A cobalt container with a source of 1500 curies and largely independent of electrical and water supplies has been developed. No water or oil cooling is necessary, and ambient temperatures up to 150°F will not influence the operation of the dust-tight, moisture-proof container. The protective container, housed in a steel container which can be rolled on its heavy steel end-flanges, is provided with a steel supporting fork. A worm wheel drive fitted to the fork enables the beam of radiation a 350° angulation. The protective container can reduce intensity of radiation at the surface to 6.25 milliroentgens per hour with a source of 1500 curies. Interchangeable diaphragms of tungsten copper alloy provide a beam of radiation 6 in. or 12 in. wide by 5 ft. long at a distance of 12 ft. from the source. Operator protection is assured while moving the source to the "exposure" position. (C.J.G.)

18020

THE ARTIFICIAL RADIOACTIVITY OF THE ATMOSPHERE IN AACHEN ON APRIL 1, 1958. H. Israel and G. Ludwig. Meteorol. Rundschau 11, No. 4, 131-2 (1958). (In German)

On April 1, 1958, in Aachen, a sudden increase in the artificial atmospheric radioactivity was observed. The increased activity was between 25 and 30 times larger than the normal level, and after a day the activity returned to its usual level. Age determinations were made, and it was established that the time of origin of the high activity was March 6, 1958. To establish the origin of the air mass which had produced the increased activity, trajectories of air currents were determined. The results showed that the origin of the air mass was the eastern Siberian coast—Kamchatka region. (J.S.R.)

18021

RADIOACTIVE FALLOUT PARTICULARLY FROM THE RUSSIAN OCTOBER SERIES. W. F. Libby (Carnegie Institution of Washington, D. C. and Atomic Energy Commission, Washington, D. C.). Proc. Natl. Acad. Sci. U. S. 45, 959-76(1959) July.

The intensive series of bomb tests fired by the USSR during October (1958) affords a unique opportunity to test whether stratospheric radioactive fall-out from injections made at polar latitudes differs appreciably in distribution or fall-out rates from that due to equatorial explosions, such as the United States and the United Kingdom have fired. The Russian October series is estimated, on the basis of assumptions previously described, to have added about 12.5 to 15 megatons equivalent of fission products to the stratosphere. The previous inventory on the same basis was about 18 megatons equivalent if polar debris falls out in about 1 year instead of 5. The Russian addition amounted to a sudden increase of about 150 per cent in the Northern Hemisphere, if one takes the previous stratospheric burden to have been uniformly distributed. The Department of Defense has tentatively concluded on the basis of data which it has collected, together with the Atomic Energy Commission's stratospheric balloon data, that the residence time for Polar shots is about one year or less and that equatorial debris has a residence time of about three years. The hydrogen bombs fired over Johnson Island made tritium water in large quantities in the stratosphere and it is to be expected if the simple uniform model for equatorial injections is correct, that the rains all over the world will show a stratospheric tritium drip as well as the stratospheric strontium-90-cesium-137 fission product drips which have been occurring for years. But this stratospheric tritium drip probably will have had its zero time in August of 1958 since earlier tropospheric firings probably added relatively less. This tritium should be useful in studying the normal hydrological cycles of the atmosphere and hydrosphere and the circulation patterns of the oceans. The Russian October shots having been fired in cold dry Polar air may have left more in the stratosphere than other tropospheric explosions and this coupled with the shorter residence time of the Martell theory should add appreciably to the Johnson Island tritium water fall-out in the Northern Hemisphere. (C.H.)

18022
DEPOSITION OF STRONTIUM-90 THROUGH OCTOBER 1958. Merril Eisenbud (U. S. Atomic Energy Commission, New York). Science 130, 76-80(1959) July 10.

It is estimated that the global deposition of strontium-90 increased from 1.9 to 2.6 megacuries during the period from June 1957 to October 1958. During this time the stratospheric reservoir of strontium-90 increased from 1.4 to 4.3 megacuries. Approximately 90 percent of the deposition of debris now stored in the stratosphere will have occurred by 1970. In 1958, the strontium-90 content of powdered milk in the New York area averaged 5.9 micromicrocuries per gram of calcium in comparison with 3.9 micromicrocuries per gram of calcium for the previous year. For this region of the country, the strontium-90 content of milk appears to be increasing in proportion to the strontium-90 content of the soils from which the cows derive their forage. The upper limit of foreseeable contamination in milk can be estimated by assuming that this proportionality will continue until all of the strontium-90 has been deposited from the upper atmosphere. This procedure should yield estimates which tend to err on the side of safety. In this manner, it is estimated that the maximum foreseeable sustained level of milk contamination in the New York area is 11 micromicrocuries per gram of calcium. A child deriving its calcium from dairy sources may be expected to develop a skeleton having 5.5 micromicrocuries per gram of calcium. This estimate is double that made in June 1957 and reflects the increased stratospheric inventory due to U.S.S.R. detonations in 1958. The radiological dose to the skeleton from natural sources such as cosmic rays, radium, potassium, and so forth, is approximately 125 millirems per year. A skeletal burden of 5.5 micromicrocuries of strontium-90 per gram of calcium will deliver a dose of approximately 5.5 millirems per year to the bone marrow. The maximum foreseeable dose from strontium-90 in the New York area is thereby estimated to be about 5 percent of the dose due to natural radioactivity. (auth)

18023
CONTAMINATION OF THE AIR BY RADIOACTIVITY FROM THE 1958 NUCLEAR TESTS IN THE PACIFIC. L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, Jr., and A. W. Saunders, Jr. (Naval Research Lab., Washington, D. C.). Science 130, 161-2(1959) July 17.

By the use of bomb-produced tungsten-185 tracer, debris from the 1958 nuclear tests (Hardtack) held at the U. S. Pacific Proving Ground have been identified as they appeared in the ground-level air along the 80th meridian. A large amount of radioactivity from these tests appeared in South America, particularly at the high-altitude collecting stations. (auth)

18024
PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 18. WASTE TREATMENT AND ENVIRONMENTAL ASPECTS OF ATOMIC ENERGY. Geneva, United Nations, 1958. 631p. $16.50.

Various methods for the treatment of radioactive wastes are discussed. Procedures are described for the storage of high-level radioactive wastes. Environmental aspects of the large-scale use of atomic energy and the contribution of fission products from fall-out to the radioactivity of the environment are discussed. (C.H.)

18025
DOSIMETRIE UND STRAHLENSCHUTZ. PHYSIKALISCHE UND TECHNISCHE DATEN. (Dosimetry and Radiation Protection. Physical and Technical Data.) R. G. Jaeger. Stuttgart, Georg Thieme Verlag, 1959. 290p.

The basic numerical values, formulas, and references, which are generally used for dosimetry and radiation protection, are compiled in tabular, graphic, and mathematical form for the radiologist, physicist, engineer, and technician. Values are presented for the following: ions and ionization, radioactivity, energy, intensity, and dosage with the dosimetric magnitudes and units; corpuscular radiation; photon radiation (x and gamma rays); dosimetry of photon radiation; and radiation protection. (J.S.R.)

18026
RADIATION PROTECTION. RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. New York, Pergamon Press, 1959. 23p.

The recommendations of the International Commission on Radiological Protection are presented. The recommendations presented in this volume represent the modifications adopted at Geneva in 1956. (C.H.)

18027
SONDERAUSSCHUSS RADIOAKTIVITAT BUNDEREPUBLIK DEUTSCHLAND. ZWEITER BERICHT. (Special Committee on Radioactivity of the German Federal Republic. Second Report.) Stuttgart, Georg Thieme Verlag, 1959. 117p. DM 12.60.

The second report of the Special Committee on Radioactivity presents the latest data on contamination of air, water, soil, and food material by radioactivity of all kinds. The radiation dose of personnel working with radiations and radioactive materials is also considered, and the results obtained from film badges are given. (See NSA 13-729 for first report.) (J.S.R.)

INSTRUMENTS

18028 AECU-4245
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON GAS SCINTILLATION COUNTERS, 1949–JULY 1957. Gretchen R. Riese, comp. Sept. 10, 1957. 5p. Contract [W-7405-eng-36]. (D-BIB-11). $1.80(ph), $1.80(mf) OTS.

References to 34 reports are compiled from Science Abstracts, 1949 to July 1957, LASL Technical Library catalog, and LASL Report Library catalog. (J.E.D.)

18029 AECU-4280
General Mills, Inc., Minneapolis.
UPPER ATMOSPHERE MONITORING PROGRAM. Report No. 1907. Progress Report No. 7 Covering Period February 1, 1959 through April 30, 1959. J. Baumstark, S. Jones, R. Olson, A. Schekman, S. Stern, L. Torgeson, and W. Zeller. July 1, 1959. 74p. Project No. 89125. Contract AT(11-1)-401. $10.80(ph), $3.90(mf) OTS.

Progress is reported in studies on the physical parameters involved in the collection of airborne radioactive particles by fibrous filter mats and the development, fabrication, and improvement of equipment for the collection of radioactive particles. Data are included on the design and fabrication of a two-stage rectangular jet impactor and a gondola for the sampling of stratospheric particulate material, the development

of a focusing array impactor, the performance of fibrous filters under reduced pressures corresponding to high altitude sample conditions, and a theoretical analysis of pressure drop of fibrous filters. Experiments are proposed to determine the extent to which bacteriophages remain viable after dialysis caused by passage through a millipore filter. A mean particle size of 0.08 micron was calculated for radioactive debris collected at high altitudes. (For preceding period see AECU-4162.) (C.H.)

18030 AECU-4286

General Electric Co. Missile and Space Vehicle Dept., Philadelphia.

HIGH ENERGY STORAGE CERAMIC CAPACITOR. Quarterly Report No. 9 for January 1, 1959—March 31, 1959. J. M. Blank. 68p. Contract AT(30-1)-1963. $10.80(ph), $3.90(mf) OTS.

Improvements in the density of the ceramic capacitor were achieved by the addition of barium. Improvements in the dielectric strength were made by air annealing of five-inch-diameter capacitors. Five-inch-diameter capacitors of relatively high dielectric strength were produced. (For preceding period see AECU-4166.) (W.L.H.)

18031 AERE-Bib-120

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

PUMPS AND ELECTROMAGNETIC FLOWMETERS FOR LIQUID METALS: BIBLIOGRAPHY. May 1959. 28p. $0.63(BIS).

Supersedes AERE-Inf/Bib-93(4th Ed.).

This bibliography of unclassified literature supersedes AERE-Inf/Bib-93(4th edition), which was compiled in 1956. The scope has been widened to include references on mechanical pumps for liquid metals, as well as on the electromagnetic types. Recently declassified reports have been included. Patent literature and Progress Reports other than Final Reports on projects have been omitted. In the section on electromagnetic flowmeters, a number of general papers, which do not refer specifically to liquid metals, but which are, nevertheless, of considerable interest, have been included. Author and report number indexes have been added at the end of the bibliography. (auth)

18032 AERE-M-421

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A PROPOSED ANGLE SENSITIVE DETECTOR FOR HEAVY PARTICLES AND ITS APPLICATION TO CORRELATION STUDIES. P. E. Cavanagh. May 1959. 8p. $0.25(BIS).

A two-element heavy particle scintillation detector is proposed which can replace up to eight conventional detectors in an angular array. Two of these detectors used in coincidence would provide a powerful means of performing correlation experiments, such as the investigation of the (p, 2p) reaction. A coincidence rate of the order of 50 times that from the usual arrangement, with two narrow angle detectors, could be expected. (auth)

18033 CERN-59-24

European Organization for Nuclear Research, Geneva.

INFORMAL MEETING ON HEAVY LIQUID BUBBLE CHAMBERS HELD AT CERN, GENEVA ON JANUARY 26-27, 1959. Summary of Proceedings. July 2, 1959. 75p.

An informal meeting on heavy liquid bubble chambers was held at CERN, with participants from several European laboratories interested in doing work at the Proton Synchrotron. The papers presented and a major portion of the general discussions are fully reported. Experimental facilities at the Proton Synchrotron are described, experience with some existing bubble chambers is reviewed, and the characteristics of large chambers with various working fluids are tabulated. (D.E.B.)

18034 HW-49447

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

INFORMATION FOR THE APPLICATION OF A CONTACT ALPHA MONITOR. P. E. Brown. Mar. 26, 1957. Decl. June 15, 1959. 10p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

A scintillation-type α monitor is described which was designed to be used with the sensing element directly in contact with the process solutions. The α particles interacting with the zinc sulfide phosphor produce scintillations detectable with a multiplier phototube and the required electron counting apparatus. Application of the monitor to the measurement of Pu concentration in aqueous solutions is discussed. (C.H.)

18035 KAPL-2006

Knolls Atomic Power Lab., Schenectady, N. Y.

TRANSISTORIZED LOG-PERIOD AMPLIFIER. E. J. Wade and D. S. Davidson. June 1959. 14p. Contract W-31-109-Eng-52. $0.75(OTS).

A log-period amplifier which is combined with power supply on a rack-mounted chassis with a 7-in. panel is described. The circuits are transistorized except for electrometer tubes and log diodes. Input power is 25 watts. Noise reducing and calibrating circuits as well as a catching circuit to keep the log diode in its logarithmic range are built into the amplifier. (auth)

18036 NARF-59-21T

Convair, Fort Worth, Tex.

TELEVISION INSPECTION CAMERA MOBILITY EXPERIMENTS. P. L. Marjon. June 12, 1959. 33p. Project 6(1-9964). Contract AF33(600)-32054. (MR-N-240).

The application of closed-circuit television in the inspection of nuclear aircraft is under study at Convair-Fort Worth. Previous testing demonstrated that televised viewing of aircraft components is a satisfactory substitute for normal viewing. A continuation of the experimental investigation of remote inspection is described. These tests were performed to resolve only the uncertainties connected with camera deployment. From a simulation of a shielded inspection vehicle cab, a man controlled the movement of a camera in maneuvers representative of aircraft remote-inspection motions. On different test setups the effect of changing the physical layout of the equipment was evaluated and an optimum arrangement of an inspection vehicle was determined. The objective was realized of ascertaining a configuration which does not require special skill in operation and which is relatively uncomplicated in construction. (auth)

18037 NP-7749

Kellex Corp. Silver Spring Lab., Md.

HIGH TEMPERATURE MICRO-HARDNESS TESTER. Technical Report No. M-5. Paul S. Bergh. Dec. 23, 1948. 30p. Contract NOrd-9829.

A micro-hardness tester has been constructed which

will determine the hardness of a metal, according to the Diamond Pyramid Hardness Number scale, at temperatures up to 1650°F. Testing is done in a vacuum of approximately 10^{-3} mm Hg. Indenter load is hydraulically applied and is controllable to within 1.2 grams over the range of 25 to 300 grams. Temperature is automatically controlled to ±2°F over the entire testing range. Provision is made for making up to 150 indentations on each of as many as twelve specimens in one run, without breaking the vacuum or disturbing temperature equilibrium. This feature makes the instrument especially adaptable for quick survey of large numbers of specimens in a search for those with likely high temperature strength properties. The lowest practical indenter load of 25 grams gives indentations small enough to make possible the study of phase changes in the microconstituents of alloys at the temperatures at which the changes occur. By resorting to higher-melting point materials in the high-temperature components of the apparatus, the temperature limit of the apparatus could in all probability be extended to that imposed by the stability of the diamond indenter. (auth)

18038 SCR-91
Sandia Corp., Albuquerque, N. Mex.
HIGH TIME RESOLUTION TELEMETRY BY MICROWAVE RF LINK. C. E. Ingersoll. May 1959. 10p. Contract [AT(29-1)-789]. $1.80(ph), $1.80(mf) OTS.

Presented at IRE Seventh Region Conference, Albuquerque, N. Mex., May 1959.

A hypothetical 20-kt nuclear detonation is considered, and the time required to complete the detonation and the peak power are calculated. Values of 0.55 μsec and 10^{21} watts were obtained. The problems which relate to the telemetry of information away from the detonation are examined. A radio-linked telemetry system operating in the microwave region is used in a hypothetical test operation to illustrate the various problems. Typical equipment is described briefly. (W.D.M.)

18039 SCTM-74-56(51)
Sandia Corp., Albuquerque, N. Mex.
INTERIM ACCELERATION RECORDING AND CONTROL SYSTEM FOR 80-FOOT DROP TESTER. F. M. McIver. June 29, 1956. 8p. $1.80(ph), $1.80(mf) OTS.

A recording and control system is used in conjunction with test vehicles which are dropped from heights of 80 feet or less. The system records longitudinal and transverse accelerations at impact, supplies time markers to recorders, and controls the sequence of independent functions necessary for the tests. (auth)

18040 SCTM-105-56(14)
Sandia Corp., Albuquerque, N. Mex.
ENGINEERING DEVELOPMENT OF TELEMETERING ANTENNAS FOR THE MACH 5 TEST VEHICLE. A. L. McMullen. May 24, 1956. 54p. $9.30(ph), $3.60(mf) OTS.

Detailed information is presented on the design and development of telemetering antennas for the Mach 5 test vehicle, a rocket-powered research missile. (J.E.D.)

18041 SCTM-122-59(52)
Sandia Corp., Albuquerque, N. Mex.
A STUDY OF THE ERROR INVOLVED IN THE NEAR USE OF A RADIO INTERFEROMETER. G. J. Simmons. Apr. 21, 1959. 25p. Contract AT(29-1)-789. $0.75 (OTS).

The results of a study of the error in radio interferometer measurements of near sources attributable to the use of asymptotic formulas are presented, valid for distant targets. It is the first thorough analysis of these errors, and equally applicable to all hyperbolic positioning systems. The computed error is presented as a function of distance and angle so that by specifying allowable error, restrictions on range and position are determined. (auth)

18042 SCTM-125-56(51)
Sandia Corp., Albuquerque, N. Mex.
MOBILE AIR GUN TEST FACILITY FOR FIRING 1/6-SCALE MODELS OF THE RECOVERABLE TEST VEHICLE. J. M. Lohse. June 15, 1956. 20p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

The gun described fires $\frac{1}{6}$-scale models of the recoverable test vehicle which is to be tested full scale from the 300-foot drop tower in Area 3. The projectile is fired downward at a ground target with a speed of about 150 feet per second. Wind drift is simulated by the motion of the truck on which the gun is mounted. The gun may be fired at various angles, fore, aft, and outboard. Data are taken by stationary Fastax cameras and by oscilloscope photography on the moving truck. (auth)

18043 UCRL-4913
California. Univ., Livermore. Radiation Lab.
REPORT ON SURFACE ACCELERATION MEASUREMENTS, USGS TUNNEL, ROOM B, NEVADA TEST SITE, APRIL 5, 1957. Stanley E. Warner. May 15, 1957. 33p. Contract W-7405-eng-48. $6.30(ph), $3.00 (mf) OTS.

Detonation of an underground charge in a tunnel was instrumented for recording accelerations at several points on the surface over the shot point. From the resulting records, it was desired to obtain the amplitude and frequency of acceleration resulting from the blast and peculiar to the configuration and material involved. Eight Statham bonded strain-gage accelerometers were arrayed within a circle of radius 150 ft from a point vertically over the shot point, 165 ft underground. Recording utilized a Heiland Model 708C oscillograph located at a vantage point approximately 2000 ft distant and connected to the transducers by multi-conductor cable. The recorder was started a few seconds before shot-time and ran approximately 15 sec after the blast. The explosion was essentially contained although several large fissures were permanently opened inside the 150 ft radius. Results are summarized. (auth)

18044 UCRL-8639
California. Univ., Berkeley. Lawrence Radiation Lab.
MECHANICAL DESIGN OF A COAXIAL VELOCITY SPECTROMETER FOR HIGH-ENERGY PARTICLES. Robert A. Kilpatrick. Feb. 1959. 13p. Contract W-7405-eng-48. $0.50(OTS).

The mechanical design of an apparatus in which crossed electrostatic and electromagnetic fields are used to separate high-energy charged particles of different masses is described. The coaxial geometry of this device allows the separation in about $\frac{2}{3}$ the space required with a parallel-plate deflector. The velocity spectrometer described was built specifically to produce enriched beams of K^- mesons or antiprotons, but it can be utilized in other applications by changing its parameters. The ratio of particle fluxes in a detector with the spectrometer off and on is 700 to 1. (auth)

18045 USNRDL-TR-323
Naval Radiological Defense Lab., San Francisco.
RECYCLING DOSERATE METER RGI-20. E. J. Wesley and T. L. Sheridan. May 18, 1959. 31p.

A hybrid tube plus transistor blocking oscillator system was adapted to a high-range gamma doserate meter for disaster survey applications. The instrument features single battery operation, a hermetically sealed input consisting of the ion chamber detector and electrometer tube, and low impedance range switching at the meter. Included is a summary of the design criteria and formulas for both the ion chamber detector and the recycling circuit, with particular reference to the mechanism of compensation for battery voltage and ambient temperature changes. The calibration setting for the instrument is maintained within 5% for battery voltage drift from 1.5 to 1.1 volts and temperature changes from 55°C to −40°C. (auth)

18046 WADC-TN-59-79

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

INVESTIGATION OF A NEW DYE-GLASS GAMMA RADIATION DOSIMETER. Period Covered: May 1957 to January 1958. Denver Hale. Mar. 10, 1959. 14p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: RADIATION EFFECTS AND MEASUREMENTS. (AD-214763).

The effects of gamma radiation on Methylene Blue, Fluorescein, Rhodamine B, Fast Red S, and Brilliant Green dyes absorbed in Corning thirsty glass (code 7930) are presented. The optical absorbency follows Beer's law with radiation dose to 10^9 erg gm^{-1} carbon. The absorption of dyes in this porous glass merits consideration as a gamma ray dosimeter. (auth)

18047 CEA-tr-R-671

SPECTROMÈTRE À NEUTRONS RAPIDES. (Fast Neutron Spectrometer.) L. F. Kondrachev, A. A. Korachev (Kourachov), A. F. Linev, V. A. Sidorov, N. I. Sokolov, and N. N. Chaldin (Chaldine). Translated into French from Pribory i Tekh. Ekspt., No. 1, 17-21(1958). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12873.

18048 CTS-590

PROPERTIES OF CERTAIN PLASTIC SCINTILLATORS. (Svoistva Nekotorykh Plasticheskikh Stsintillyatorov.) M. M. Koton, Yu. N. Panov, A. N. Pisarevskii, and T. V. Timofeeva. Translated for Dept. of Scientific and Industrial Research, London from Pribory i Tekh. Ekspt., No. 1, 49-55(1957). 8p. Price £2. (United Kingdom) £3. (Overseas) DSIR.

This paper was previously abstracted from a French translation and appears in NSA, Vol. 13, as abstract No. 8658.

18049

TIME-OF-FLIGHT NEUTRON SPECTROMETER. H. Ţotiş, P. Timiş, and C. Lazarovici. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 89-98(1959). (In Rumanian)

A time analyzer for a time-of-flight spectrometer is described. The time analyzer operates on the matrix coincidence principle and consists of 64 channels with widths from 2 to 160 μ sec. With the help of a delay line, a time interval of 32 μ sec is obtainable by the 64 channels. The recording is done by a high-speed mechanical counter. (tr-auth)

18050

γ-RAY SPECTROMETRY OF NATURAL RADIONUCLIDES. G. M. Voskoboinikov and N. P. Kartashov. Atomnaya Energ. 6, 42-8(1959) Jan. (In Russian)

Theoretical calculations are made of the strong γ spectra of equilibrium uranium and thorium, uniformly distributed in rock. The energy distribution of γ pulses produced in scintillation spectrometers is estimated. The plotted results are used in evaluating the spectral effects anticipated in γ-ray spectrometric studies of natural radionuclides. The precision of spectrometric investigations under field conditions is discussed. (tr-auth)

18051

THE DISTRIBUTION OF IONIZATION ALONG γ-RAY BEAM AND REPRODUCING THE ROENTGEN WITH NORMAL IONIZATION CHAMBERS. K. K. Aglintsev and G. P. Ostromukhova. Atomnaya Energ. 6, 63-6 (1959) Jan. (In Russian)

True ionization from γ radiation and resulting x radiation may be found from standard ionization chamber measurements by introducing a displacement factor, $\sim 0.35\ (R_{max}/P)$, for distance from the measuring electrode center. The displacement magnitude was determined and used in studies of Cs^{137} and Co^{60} γ radiation. The corrections for the displacement for Cs^{137} and Co^{60} were 0.996 and 0.992, respectively. (R.V.J.)

18052

NEW SCINTILLATION GEL FOR MEASURING THE ACTIVITY OF SUSPENSION MATERIALS. D. G. Fleishman and L. G. Shakhidzhanyan. Atomnaya Energ. 6, 669(1959) June. (In Russian)

The preparation and performance of scintillation gel prepared from plexiglas are described. A 100% efficiency was achieved in recording Cs^{137}, K^{40}, and Sr^{90} β particles, with a background of ~30 pul/min. (R.V.J.)

18053

MICROBIOLOGICAL INVESTIGATIONS ON SENSITIVITY AND RESOLVING POWER OF VARIOUS AUTORADIOGRAPHIC EMULSIONS. R. Tzschaschel. Atompraxis 5, 224-8(1959) June. (In German)

The properties of four types of autoradiographic emulsions (Kodak Ar 10 stripping film, Kodak NTB sheet film, Agfa K 102 stripping film, and Agfa K 2 pouring emulsion) were examined with yeast cells and labeled with the isotopes P^{32}, S^{35}, and C^{14}. The microbe preparations were produced by the spray method and were autoradiographed in the usual manner. The autoradiograms were evaluated by means of the "cross-counting" method. It was found that the Kodak and Agfa Wolfen emulsions are practically identical in regard to sensitivity, but that the Kodak emulsions are superior to Agfa in resolving power. (auth)

18054

DETECTION AND MEASUREMENT OF NEUTRONS WITH THE BF_3 COUNTER. II. G. Waechter (Firma Frieske-Hoepfner, Erlangen-Bruck, Ger.). Atompraxis 5, 232-6 (1959) June. (In German)

The factors which must be considered in building BF_3 counters are discussed. The cathode material must be resistant to the corrosive effect of BF_3 and must not become too activated. The purity of the filling gas influences the counting properties of the tube. The dimensions of the tube and the filling pressure determine the form of the pulse-height distribution which is to be measured by the counter. Possible uses of the BF_3 counter are indicated, especially the dosimetry of thermal and fast neutrons. (auth)

18055

THICKNESS DETERMINATION WITH GAMMA RADIATION ON BIOLOGICAL OBJECTS. H. Glubrecht, E. G. Niemann, and H. Rundfeldt (Technischen Hochschule, Hanover). Atompraxis 5, 237-9(1959) June. (In German)

The extensive use of gamma-ray permeability for determining thickness and mass in industry suggested the use of the same technique for biological objects. The special possibilities and problems involved are discussed. In particular, an apparatus which was built for determining the mass of cabbages in the field without influencing their further growth is described. The margin of error was about 4%. (auth)

18056

APPARATUS FOR INTERMITTENT RADIATION WITH β PARTICLES. J. Bednář and A. Hynšt (Militär-technische Akademie, "Antonín Zápotocký," Brno). Collection Czechoslov. Chem. Communs. 24, 2085-7 (1959) June. (In German)

An apparatus was constructed for intermittent or continuous irradiation with beta particles from an equilibrium mixture of Sr^{90} and Y^{90}. The preparation of the radiation source and the construction details of the apparatus are presented. (J.S.R.)

18057

THE ROLE OF GLASS IN RESEARCH AND APPLICATION OF ATOMIC ENERGY. Oszkar Knapp. Energia és Atomtech. 11, 647-9(1958) Sept.-Oct. (In Hungarian)

The use of lead glass as shielding material in hot cell windows is reviewed. The measurement of γ energy, the Cherenkov effect in special lead glasses, and the use of silver phosphate and cobalt borosilicate glasses for γ dosimetry by determining the darkening effect are discussed. (R.V.J.)

18058

"FLUORIMETRO CISE-CR1": A DEVICE FOR DETERMINATIONS ON SOLIDS AND LIQUIDS. E. Cerrai and G. Rossi (CISE, (Milan). Energia nucleare (Milan) 6, 399-408(1959) June.

A new device, "Fluorimetro CISE-CR1", was designed and built; it is suitable for solid and liquid specimens. It was tested for uranium, boron, and zirconium determination, giving satisfactory sensitivity. (auth)

18059

MEASUREMENTS AND STABILIZATION OF DOUBLE FOCUSING β SPECTROMETER MAGNETIC FIELD BY MAGNETIC SATURATION PROBE METHOD. O. D. Kovrigin and G. D. Latyshev (Inst. of Transportation, Leningrad). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 11, 92-7(1958) Nov. (In Russian)

Descriptions are given of an instrument for measuring and stabilizing a magnetic field. The region of measurement and stabilization of the field is from 5 to 200 gauss. Relative accuracy of measurement of the topography of a magnetic field in a beta spectrometer is from 0.02 to 0.005%, respectively. The degree of stabilization is not less than 1×10^{-4} when the main current in the electromagnet changes ±1%. (auth)

18060

TRANSISTORIZED LOG-PERIOD AMPLIFIER. E. J. Wade and D. S. Davidson (Knolls Atomic Power Lab., Schenectady, N. Y.). IRE Trans. Nuclear Sci. NS-6, 53-6(1959) June.

A log-period amplifier is described which is combined with power supply on a rack mounted chassis with a 7-inch panel. The circuits are transistorized except for electrometer tubes and log diodes. Input power is 25 watts. Noise reducing and calibrating circuits are built in as well as a catching circuit to keep the log diode in its logarithmic range. (auth)

18061

TRANSISTORIZED LINEAR PULSE AMPLIFIERS. Stanley C. Baker (Univ. of California, Berkeley). IRE Trans. Nuclear Sci. NS-6, 57-63(1959) June.

The basic investigation of transistor feedback amplifiers has proven mathematically simple and of great practical value. The behavior of single-stage common-emitter amplifiers is described and provides a building block with which cascaded feedback amplifiers can be analyzed and designed. The problem of designing these amplifiers is complex, and what are felt to be the most important phases of the problem are discussed. (auth)

18062

BEAM-PROFILE INDICATOR. H. G. Jackson, D. A. Mack, and C. Wiegand (Univ. of California, Berkeley). IRE Trans. Nuclear Sci. NS-6, 64-9(1959) June.

An instrument is described for displaying intensity profiles of charged-particle beams that emerge from high-energy accelerators. The intensity vs. position on a strip of 21 scintillation counters each 1 by 1 cm appears as a histogram on an oscilloscope. The display is accomplished by employing transistor circuits to amplify and integrate the outputs of the multiplier phototubes. The accumulated charge associated with each counter element is then read out in sequence by means of a blocking-oscillator commutator. The output signal is further amplified logarithmically for oscilloscope deflection. Block and circuit diagrams are given for the system. (auth)

18063

OPTIMIZATION OF A CONVENTIONAL-FUEL-FIRED THERMOELECTRIC GENERATOR. B. W. Swanson and E. V. Somers (Westinghouse Research Labs., Pittsburgh). J. Heat Transfer 81, 245-8(1959) Aug.

Conditions for optimizing the thermal efficiency of the design of a conventional-fuel-fired thermoelectric generator were investigated. Equations are developed for the following: the temperature distribution of the heated gas in a circular duct type of generator, that maximizes the thermoelectric power output, with respect to the temperature distribution within the duct and the exit gas temperature at the end of the duct; the thermoelectric power developed, based upon these optimizing temperature criteria; the required variation of thermoelectric element thickness required to satisfy both optimizing temperature criteria; and thermal efficiency under optimum conditions. (auth)

18064

THE SLOTTED CONE SPLITTER. F. J. Flanagan, R. C. Kellagher, and W. L. Smith (U. S. Geological Survey, Washington, D. C.). J. Sediment. Petrol. 29, 108-15(1959) Mar.

A laboratory sample splitter was designed in the form of a 60° cone over whose surface the entire sample passes. The split is captured by falling through pie-shaped slots on the surface of the cone. The splitter sampled an average of 13.5% of a crushed quartz monzonite, of which 80% passes a 140-mesh sieve. The amount of sample captured is dependent on the particle size of the material sampled. A line of regression of the percent captured on size and confidence limits for the estimate of the means of the amount split are shown. Some qualities desirable in a splitter are enumerated

and the conformity of several splitters to these criteria is discussed. (auth)

18065

DOSIMETRY OF RADIOISOTOPES BY A WINDOWLESS COUNTER AND ITS COMPARISON WITH THE RESULTS OF MEASUREMENTS BY THE WINDOW GM TUBE. Josef Klumpar, Miroslava Majerova, and Pavel Jiroušek (Dosimetrické oddělení UJV-ČSAV, Prague). Jaderná energie 5, 190-3(1959). (In Czech).

The design of a 4π flow counter and its properties are described. Corrections for the thickness of the supporting membrane for radioisotopes of various β-radiation energy have been determined, and the results of measurements of the activity are compared with the results obtained with GM tube. In conclusion the errors of measurements are discussed and compared with those of foreign authors. (auth)

18066

SUPPLEMENTARY EQUIPMENT TO A COUNTER FOR EVALUATION OF ITS STATE. Jiri Macků. Jaderná energie 5, 194-8(1959). (In Czech.)

Description is given of equipment which, in connection with any given decade counter and value printer, makes possible a five place registration of the impulses received. Simultaneously the apparatus permits count preset in required number from 10 to 10^5 with an accuracy of 1% so that it is possible to use any ordinary counter for the majority of automatic nuclear measurements. (auth)

18067

ON THE RADIOGRAPHIC MERITS OF THE 1000 PKV RESONANT TRANSFORMER AND THE VAN DE GRAAFF X-RAY GENERATORS. D. E. Elliott and C. M. Knowles (Los Alamos Scientific Lab., N. Mex. and Union Carbide Nuclear Co., Oak Ridge, Tenn.). Nondestructive Testing 17, 205-9(1959) July-Aug.

An experimental comparison of a 1000-pkv resonant transformer x-ray generator and a 1000-kv Van de Graaff x-ray generator has been conducted based on the technical aspects of the units as they are applied to industrial radiography. Radiographic exposure techniques and resolution data from the application of the generators to the radiography of aluminum sections up to 10 inches, steel sections up to 6 inches, and uranium sections up to 1 inch are presented. Field intensity distribution, experimental focal spot data, and direct radiographic enlargement data are also presented. It is concluded that the resonant transformer unit has a slight advantage in the contact radiography of thin to moderate sections, and that the Van de Graaff unit has a slight advantage in the application to thicker sections and a definite advantage in direct radiographic enlargement. (auth)

18068

COMPUTERS AND THE PISA STUDY CENTER OF COMPUTERS. M. Conversi (Università, Pisa, Italy). Nuovo cimento (10) 11, Suppl. No. 3, 376-96(1959). (In Italian)

The development of computers is briefly reviewed, and the computer center at the University of Pisa is described. Computer origin and evolution, analog and numerical machines, structure of a computer, principal constituent parts, and the principal characteristics of the instrument are surveyed. The computers in existence or under construction are tabulated. The use of the computer by the nuclear engineer is reviewed. The origin, organization, and purpose of the Pisa Center are discussed. (J.S.R.)

18069

ON FIXING SOLUTIONS FOR NUCLEAR EMULSIONS. D. Heughebaert and J. Heughebaert (Istituto Nazionale di Fisica Nucleare, Milan). Nuovo cimento (10) 12, 623-6(1959) June 16.

Clearing time, swelling, transparence, and corrosion of Ilford K-5 emulsion in fixing solutions of 3 different compositions have been studied, and a solution chosen which, while reducing the clearing time and the danger of corrosion, does not increase the opacity, nor, to any appreciable extent, the swelling of the emulsion. (auth)

18070

SOME APPLICATIONS OF THE ELECTROSTATIC ANALYZER OF ELECTRON VELOCITIES. A. N. Kabanov and V. I. Milyutin. Radiotekh. i Elektron. 4, 321-9(1959).

The energy loss of electrons scattered by thin films was measured with an electrostatic analyzer, whose operation is described. All measurements were made at an accelerating potential of 30 kv, and the resolving power of the analyzer was 0.6 ev. Spectra of aluminum oxide, gold, silver, antimony, aluminum, and carbon films were obtained and used to evaluate the energy loss. The effect of the ripple in the supply voltage was investigated and the results are shown graphically. (TCO-J.S.R.)

18071

PHOTOELECTRIC MULTIPLIER FOR SCINTILLATION GAMMA SPECTROMETERS. L. G. Leiteizen, B. M. Glukhovskoi, and I. Ya. Breido. Soviet Phys.-Cryst. 2, 286-9(1957) Mar.-Apr.

The multipliers having amplitude resolutions $R \approx 9\%$ are discussed in relation to multipliers having $R > 9\%$. Factors affecting amplitude resolutions are brought out in the discussion. Tabular results show that the energy resolution of the spectrometer could be improved at the expense of the crystal. (C.J.G.)

18072

PRESENT PROBLEMS OF THE DOSIMETRY OF IONIZING RADIATIONS. Hermann Muth (Universitäts des Saarlandes, Homburg, Saar, Ger.). Strahlentherapie 109, 412-25(1959) June-July. (In German)

A survey was made of the historic development of terms and units in dosimetry of ionizing radiation. The latest recommendations of the International Commission for Radiological Units are discussed. Conclusions and recommendations are made. The energy dose, based on absorbed energy was considered the fundamental unit in dosimetry. For practical reasons a dose unit, which is based on ionization, will still be necessary besides the energy dose. (auth)

18073

AIMA-2 PULSE-HEIGHT ANALYSER. M. V. Pasichnik, R. G. Ofengenden, and L. D. Konenko (Inst. of Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 57-71(1959) Jan.-Feb. (In Ukrainian).

A description of the principal circuit of the AIMA-2 pulse-height analyzer is presented. Discrimination of pulses is effected by the principle of amplitude-time transformation. The storing of the number of pulses in each channel is produced on a magnetic drum. The results of the measurements are represented on a double-beam electron tube in a binary and a linear scale. The technical data of the instrument are:

number of channels, 50 or 80; capacity of each channel when operating on 50 channels, 65,535 pulses; resolving time, 1.3 msec; maximum loading of analyzer, 5000 pulses per second. The instrument is capable of analyzing only such pulses as coincide in time with the driving pulse. The instrument consists of two units (a measuring and a power unit), each of which is of the size of a table oscillograph. (auth)

18074

DISPERSION DETECTORS OF FAST NEUTRONS. Yu. A. Tsirlin. Zhur. Tekh. Fiz. 29, 530-8(1959) Apr. (In Russian)

Studies were made of fast neutron detectors with the scintillation granules dispersed in transparent hydrogen media. A formula is derived for light inference from the detector, and an evaluation was made of the efficiency of the detector for both neutrons and γ rays. (tr-auth)

18075

SOVERMENNOYE OBORUDOVANIYE DLYA RABOTY S RADIOAKTIVNYMI IZOTOPAMI; SBORNIK MATERIALOV. (Modern Equipment for Working with Radioactive Isotopes; Collection of Materials.) A. I. Zavodchikova and S. M. Popova, eds. (Suppl. No. 5, to Atomnaya Energ. (1958)). Moscow, Izd-vo Glavnogo Upravleniya po Ispol'zovaniyu Atomnoy Energii pri Sovete M-va SSSR, 1958. 110p.

A book for personnel engaged in activities involving the use of radioisotopes is presented. Three articles deal with modern techniques, methods, and apparatus for handling radioisotopes. Schematic diagrams and illustrations of modern equipment for remote handling and detailed descriptions of operating principles are given. (TCO-J.S.R.)

18076

BACK-SCATTER MEASURING GAUGES. (to E. K. Cole, Ltd. and Robert Gordon Davis). British Patent 814,286. June 3, 1959.

A back-scatter measuring gage is described which is equipped for standardization and adjustment for source decay or contamination effects. A standard plate of known back-scatter properties is inserted between sources and material to be measured so that a standard signal is produced in the indicating circuit. (T.R.H.)

18077

IMPROVEMENTS IN OR RELATING TO MEANS FOR THE DETECTION OF RADIATION EMPLOYING AN IONISATION CHAMBER. (to E. K. Cole, Ltd. and Robert Gordon Davis). British Patent 814,718. June 10, 1959.

An ionization chamber which gives an a-c signal in response to ionization is described. The ions formed are beamed and deflected back and forth between two collecting electrodes within the chamber. The electrodes are coupled to the oppositely phased input terminals of a push-pull amplifier, the output of which is fed to a phase detector. An auxiliary electrode, having circular cross section and tapered, protects the collecting electrodes from the a-c potentials of the deflecting electrodes. (T.R.H.)

18078

IMPROVEMENTS IN OR RELATING TO APPARATUS USING A RADIOACTIVE MATERIAL AND AN IONISATION CHAMBER. (to E. K. Cole Ltd.). British Patent 814,890. June 17, 1959.

An ionization chamber design is offered which has a foraminous collector electrode into which projects a metal extension from a metal wall of the chamber. The chamber is equipped with a window for radiation and is enclosed in an air-tight vessel with means for regulating pressure within. (T.R.H.)

18079

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR HANDLING NUCLEAR REACTOR FUEL ELEMENTS. Ronald Scott Challender and Herbert Chilvers Knights (to United Kingdom Atomic Energy Authority). British Patent 814,996. June 17, 1959.

A machine for removing the sheaths from clad fuel elements is described. A circular die is forced between clad and fuel. Special provision is made for aligning the fuel element with the die and for preventing bowing of the fuel element when the initial cut through the end cap is made. (T.R.H.)

18080

RADIO-ACTIVE GASEOUS GAUGING SOURCE. (to Foxboro Co.). British Patent 815,401. June 24, 1959.

A Kr^{85} source arrangement for use in radiometric thickness gages is described. The Kr^{85} gas is contained in a stainless steel cylinder with brass end plugs; one plug has a filler tube. This container is inside a shield tube with a window for radiation. The window can be rotated to a shielded position. The pressure in the device can be changed by means of a bellows arrangement to regulate gas density and, thereby, the radiation intensity. Provision is also made for filling and emptying the gas chamber of one or more sources from one line, adjusting to the desired radiation intensity, a separate adjustment for each source. The source window is flexible so that atmospheric pressure variations are compensated. (T.R.H.)

18081

REMOTE CONTROL MANIPULATOR. Demetrius George Jelatis. British Patent 815,515. June 24, 1959.

A master-slave arm arrangement is described in detail. (T.R.H.)

18082

REMOTE CONTROL MANIPULATOR. Raymond Corlis Goertz, Roland Godfrey Schmitt, Jr., and Robert Arthur Olsen. British Patent 815,516. June 24, 1959.

A master-slave arm arrangement is described in detail. (T.R.H.)

18083

IMPROVEMENTS IN OR RELATING TO VOLTAGE MEASURING CIRCUITS. Michael Oliver Deighton (to United Kingdom Atomic Energy Authority). British Patent 815,539. June 24, 1959.

A voltage measuring circuit is described which can be used effectively in a multi-channel pulse amplitude analyzer. The circuit comprises an amplifier, a feedback connection for the amplifier, a switch for changing the sign of the feedback, and a capacitor. With negative feedback the amplifier charges the capacitor to the peak voltage of an input pulse; by switching to positive feedback the drop of the capacitor voltage to its original value is detected. The amplifier may comprise a long-tailed pair in cascade with a secondary emission pentode so that the switch can be triggered by a signal from the long-tailed pair. (T.R.H.)

18084

IMPROVEMENTS IN OR RELATING TO DIFFRACTION APPARATUS FOR X-RAYS OR GAMMA RAYS. (to Philips Electrical Industries, Ltd.). British Patent 816,153. July 8, 1959.

An arrangement of x- or gamma-ray source with sample holder, collimator, and detector is described. Provision for calibration is included in the form of an easily changeable source. (T.R.H.)

18085
AN ELECTRIC DISCHARGE DEVICE. Frank Oppenheimer. British Patent 816,776. July 22, 1959.

A calutron ion source is described. A slot is provided which defines the cross section of the arc. (T.R.H.)

ISOTOPES—INDUSTRIAL TECHNOLOGY

18086
EQUIPMENT FOR INVESTIGATIONS OF THE TECHNOLOGICAL RADIATION PROCESSES USED WHEN WORKING UP PLASTIC MATERIALS AND INDIA RUBBER. Josef Šimorda. Jaderná energie 5, 151-6(1959). (In Czech.)

A description is given of the sources of ionizing radiation of high-intensity for investigations of technological radiation processes used when working up plastic materials and india rubber. The principal applications of technological radiation processes in the branch of plastic materials and rubber are given and various sources of ionizing radiation suitable for given purposes are described. Further on a technical and economical comparison is drawn between the cobalt sources and linear accelerators. In conclusion a cobalt source VŮGPT of 230 c activity is described. (auth)

METALLURGY AND CERAMICS

18087 AECU-3757(Pt. III)
Michigan. Univ., Ann Arbor. Engineering Research Inst.
TESTS ON MODELS OF NUCLEAR REACTOR ELEMENTS. III. HEAD LOSSES IN CORE SUB-ASSEMBLIES. J. S. McNown, R. A. Yagle, and A. Spangos. July 1957. 22p. For Atomic Power Development Associates, Inc. $4.80(ph), $2.70(mf) OTS.

Losses have been determined for flow through models of various proposed core sub-assemblies as part of a study of the elements of a nuclear reactor. Six core sections and two axial blanket sub-assemblies have been compared on the basis of drop in piezometric head or pressure drop. The core sub-assemblies are composed of an entrance nozzle, a lower axial blanket section, the core section, an upper axial blanket section, and a short section for the handling lug. The four parts of the sub-assembly other than the core section are designated as the axial blanket sub-assembly. In each core section there are 144 rods within a container which has a square cross section. The primary differences between one core section and another are the means of supporting and spacing the rods. Bars or wires wrapped in spirals around the rods were used as well as a series of grids made up of wires and supported at the four corners. Also, in one core an inner wall was used to provide an annular flow passage which helps to reduce the difference in temperature at the inner and outer walls of the core. The two axial blanket sub-assemblies tested are similar except that the second model is characterized by more gradual transitions in changes of cross section. (auth)

18088 AECU-4252
Denver. Univ. Denver Research Inst.
STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON—ALUMINUM ALLOYS. Frank C. Perkins and Joseph F. Nachman. July 8, 1959. 7p. Contract AT(11-1)-742. $1.80(ph), $1.80(mf) OTS.

The effects of variations of Al content, heat treatment, and basic slip mechanism upon the room-temperature ductility of Fe—Al alloys are being determined. (W.L.H.)

18089 BMI-1324
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING FEBRUARY 1959. Russell W. Dayton and Clyde R. Tipton, Jr. Mar. 1, 1959. Decl. June 12, 1959. 73p. Contract W-7405-eng-92. $2.00(OTS).

Measurements of the thermal conductivity of unirradiated U and UO_2 were completed. An evaluation is being made of the creep properties of annealed and 15% cold-worked Zircaloy-2 at elevated temperatures in order to determine the suitability of Zircaloy-2 for process tubing in the NPR. Single crystals of high-purity Mo are being grown for irradiation studies. Research to identify factors affecting irradiation-induced volume changes in graphite by means of sink-float density measurements was continued. Hollow cylindrical tubes of Al—U alloys clad inside and outside with Al are being developed. A radiometric method for the determination of Ca is under study. An investigation of the mechanism of solidification of U metal in cylindrical graphite molds was continued. A study to evaluate arc spraying as a method for coating Ni with Ca is reported. Work on the valence effects of Y_2O_3, CaO, and La_2O_3 additions to UO_2 was continued. The investigation of the structure of U—Zr alloy hydrides for potential use in fueled moderators is nearing completion. The changes in mechanical properties of AISI Type 347 stainless steel as the result of exposure to a fast-neutron flux is being investigated. Corrosion data are presented for commercial-purity Nb-base alloys. Data are presented on the creep behavior of high-purity Nb and Nb-base alloys. Work was continued on the development of Nb—U alloys. Improvement of the irradiation-damage resistance and of the corrosion resistance of Th—U alloys is being sought by means of alloying and process control. The gas-pressure-bonding technique is being investigated as a method for cladding cermet and ceramic-type fuels with Mo and Nb. The high-temperature irradiation behavior of dispersion fuel elements consisting of 24 wt. % UN and UC dispersed in stainless steel is being evaluated. An investigation of the mechanism and kinetics of solid-state bonding of metals by the application of heat and pressure is in progress. Fatigue studies of Inconel and INOR-8 were continued. A fundamental study of the reactions of N_2 with Nb is being made. An investigation of the constitution of U—Nb alloys is in progress. A study of post irradiation fission-gas release from UO_2—graphite spheres at elevated temperatures was started. Mean linear-thermal-expansion coefficients for irradiated Th—11 wt. % U specimens are reported. The compatibility of Ta and Ta alloys with Pu is being investigated. A flat-plate Zircaloy-2-clad fuel element containing compartmented UO_2 fuel is being considered for Core 2 of the PWR. The postirradiation examination of UO_2

samples was completed. Techniques are being studied for fabricating graphite–matrix bodies containing 20 vol. % of fuel compound in the form of UC or UC_2. (For preceding period see BMI-1315.) (W.L.H.)

18090 BMI-1340
Battelle Memorial Inst., Columbus, Ohio.
PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING APRIL 1959. Russell W. Dayton and Clyde R. Tipton, Jr. May 1, 1959. Decl. June 12, 1959. 108p. Contract W-7405-eng-92. $2.50(OTS).

The utilization of 15% cold-worked Zircaloy-2 as material for process tubes for the NPR has indicated the need for study of the creep properties at elevated temperatures. Single crystals of high-purity Mo are being grown in a modified Andrade furnace. Research to identify factors affecting irradiation-induced volume changes in graphite by means of sink-float density measurements was continued. The simulation of conditions after loss-of-coolant incident in the PRTR by means of a digital computer was continued. The study of the radiometric analysis of Mg was resumed. The program on radiation-induced graft polymerization is continuing with emphasis on the investigation of factors influencing the formation of free-radical and peroxy grafting sites. A study of the effect of gamma radiation on nitration reactions in the HNO_3–cyclohexane system is reported. The manner in which U metal solidifies in cylindrical graphite molds is being studied. A study to determine the feasibility of coating Ni and Ni alloys with Ca by the arc-spraying method is presented. A project to investigate the effects of Y_2O_3, La_2O_3, and CaO additions to UO_2 with regard to stabilizing the UO_2 fluorite structure under both oxidizing and reducing conditions is presented. An evaluation is being made of the changes in the mechanical properties of AISI Type 347 stainless steel after exposure to a fast-neutron flux at ~120 and 600°F. Several Nb-base alloys are being evaluated for applications as alternate cladding materials in future EBR cores. Alloys selected for study include Nb–Cr, Nb–Zr, Nb–Ta–Cr, Nb–Ti–Cr, Nb–Ti–Al, unalloyed Nb, and a comparison alloy of V–Ti–Nb. A program of research designed to secure a basic understanding of the parameters involved in the friction and wear behavior of rubbing surfaces lubricated by high-temperature Na is in progress. Corrosion data are presented for U–Nb alloys in air, water, and steam. Development of Th–U-base alloys with improved irradiation-damage resistance and corrosion life is being sought by means of ternary and quaternary alloying and process control. A study is presented of gas release from sintered UO_2 bodies during postirradiation heating and during actual exposure to neutron flux in the BRR. Techniques are being developed for the fabrication of high-density cermet elements consisting of 60 to 90 vol. % of UO_2, UN, or UC combined with stainless steel or Nb. Ceramic fuels and Nb- and Mo-base cermet materials are being clad with Mo and Nb by use of the gas-pressure-bonding process. Techniques for the production of UC of 95% of theoretical density or better by powder metallurgy is being investigated. Fatigue studies of Inconel and INOR-8 were continued. A fundamental study is being made of the kinetics and mechanisms of the reaction of N_2 with Nb. The constitution of U–Nb alloys is being investigated by means of diffusion couples to establish the composition limits of the gamma-phase immiscibility gap in the system. Evaluation of UC_2–graphite spheres by measurement of postirradiation fission gas release at elevated temperatures was continued. Ni-o-nel specimens were exposed to boiling Sulfex-Thorex process solutions containing dissolved type 304 stainless steel. Titanium is being evaluated as a material of construction for the Darex-Thorex dissolution process. A series of Ta-alloy strip specimens containing additions of either C, Re, or Y was tested for Pu-alloy compatibility. The effect of irradiation on Ta is being investigated. The studies concerned with the development of a plate-type oxide fuel element for the PWR were continued. Techniques are being developed for coating of UO_2 cores with graphite, carbon, and chromium to prevent reaction between the UO_2 cores and Zircaloy cladding. Fuel element cores of UO_2 particles dispersed in a densely sintered BeO matrix are being developed. Work on the development of fuel, absorber, and suppressor materials for the SM-2 is reported. (For preceding period see BMI-1330.) (W.L.H.)

18091 BMI-1351
Battelle Memorial Inst., Columbus, Ohio.
THE ROLE OF CREEP IN THE GAS-PRESSURE-BONDING PROCESS. Stephen D. Beck and Michael A. Gedwill, Jr. June 23, 1959. 46p. Contract W-7405-eng-92. $1.50(OTS).

A theoretical method of determining the time, temperature, and pressure required for pressure bonding was proposed and then evaluated experimentally. The analysis considered only the mechanical deformation of the bonding surfaces induced by the external pressure. It was postulated that such deformations obey the power law for steady creep. The application of the law to the closure of thick-walled aluminum cylinders under gas pressure was investigated. The behavior was compared with that predicted from creep data obtained from short-time torsion creep tests. Only fair agreement was established. The creep law was then applied to the calculation of the closure of voids at the interface between bonding surfaces. It was assumed that the voids exist as isolated spherical or cylindrical holes. The law failed to predict the total closure which occurred. Apparently, the creep law does not hold in the almost microscopic domain of the interfacial voids, although the disagreement may have been due to the over-simplification of the geometric representation. Resolution of the ambiguities probably will be attained only when sufficient experimental data to establish an empirical relationship of closure with bonding conditions are available. (auth)

18092 BMI-1354
Battelle Memorial Inst., Columbus, Ohio.
FATIGUE STUDIES OF INOR-8. Raymond G. Carlson. June 26, 1959. 19p. Contract W-7405-eng-92. $0.75 (OTS).

To develop fatigue-design information for the ORNL reactor programs, a study was made of the fatigue behavior of INOR-8, a nickel–molybdenum–chromium alloy for high-temperature service. The temperature and frequency dependence of fatigue properties of INOR-8 were determined by rotating-beam fatigue tests. Stress-lifetime data were obtained for temperatures of 1100, 1300, and 1500°F, and cyclic frequencies of 100, 600, and 3000 cpm. The fatigue strength of INOR-8 was found to decrease with increasing temperature. No appreciable frequency effect was found up to 1300°F. At 1500°F, there was a definite frequency effect, for the fatigue strengths of specimens tested at frequencies of 600 and 3000 cpm were equal, while the

fatigue strength for tests at a frequency of 100 cpm was substantially lower. The studies indicated that there is a critical frequency associated with each temperature, above which frequency has no effect, but below which fatigue strength decreases with decreasing frequency. It was found that fatigue strength was higher for the finer grained material evaluated. (auth)

18093 DMIC-Memo-23
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
BAND SAWING OF TITANIUM AND TITANIUM ALLOYS. Carl T. Olofson. July 1, 1959. 15p.

Band-sawing is being accomplished under conditions adapted to the general machining behavior of titanium. The difficulties encountered in other metal-cutting operations are also encountered in sawing. They result from galling, smearing, abrasiveness, and the generation of high temperatures in the cutting zone. Many difficulties can be minimized by selecting the proper saw pitch and feeding pressure for the work thickness involved. Also, a proper relationship of band velocity and feed must exist for economic tool life. (auth)

18094 DMIC-Memo-24
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
HACKSAWING OF TITANIUM AND TITANIUM ALLOYS. Carl T. Olofson. July 6, 1959. 12p.

Titanium and its alloys can be hacksawed under cutting conditions adapted to the behavior of titanium. The difficulties encountered in other machining operations are also present in sawing. They include galling, smearing, abrasiveness, and the generation of high temperatures in the cutting zone. During the sawing process, a tiny chip forms as each saw tooth penetrates the work. Chips gradually enlarge and curl into each tooth gullet as the blade moves through the cut. The chips remain trapped in the gullets until the teeth emerge from the kerf. At that time, chips either fall out or are flushed out by the cutting fluid directed into the cutting zone. The objectives in hacksawing include straightness of cut, smoothness of cut surface, ample cutting rates, and reasonable tool life. Appropriate selections of pitch, speeds, and feeds not only should minimize the sawing difficulties of titanium, but also should create an economic balance between cutting rate and blade life. Cutting rates for titanium are about 25 to 50% lower than those associated with quenched and tempered alloy steels of equivalent hardness. Blade life in terms of productivity is about 50% lower than that with alloy steels of equivalent hardness. (auth)

18095 DMIC-Memo-25
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PROFILE MILLING TITANIUM AND ITS ALLOYS. Carl T. Olofson. July 10, 1959. 4p.

Profile milling is a method of milling in which the path of a single-spindle cutter is guided and controlled by a stylus tracing a master form or a template made to the contour, shape, or pattern to be reproduced on the workpiece. When profile milling titanium and its alloys, vibrations must be held to an absolute minimum. Vibrations, when present, are induced in the cutter stylus and hence are reproduced at the cutter spindle. These add to any vibrations already present at the cutter. The result is poor tool life, even fracture of harder cutter materials such as carbides. (auth)

18096 DMIC-Memo-26
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
SPINDLE SHAPING OF TITANIUM SHEET. Carl T. Olofson. July 15, 1959. 4p.

Spindle shaping is a hand-fed, edge-profiling operation for certain types of sheet-metal parts. The blank is firmly clamped to a template of desired edge contour. By means of a suitable fixture, the template and blank are then hand fed into an inverted single-spindle cutter protruding through a table. A bearing surface on the milling-type cutter traces the contour of the template, thereby guiding the cutter as it cuts the profile of the part. Parts can be produced from titanium and titanium-alloy sheet with aircraft-quality edge finish. This method is feasible for shaping sheet metal in gages from 0.060 to 0.187 inch using carbide cutters and carbon dioxide as a coolant. (auth)

18097 EXP-NRX-1802
Atomic Energy of Canada Ltd., Chalk River, Ont.
FABRICATION OF URANIUM OXIDE SPECIMENS. THE X-2-q LOOP CHARGE. E. Mizzen and E. Barnes. July 1959. 16p.

Fabrication and pre-irradiation data of UO_2 fuel for the x-2-q charge are reported. (auth)

18098 HW-59323
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A CARBON ARC IMAGE FURNACE AND MICROSCOPE FOR STUDIES AT HIGH TEMPERATURES. H. W. Newkirk and B. B. Brenden. May 20, 1959. 30p. Contract W-31-109-Eng-52. $1.00(OTS).

The optical principles and operational and radiation characteristics of a 10-kw carbon arc image furnace employing paraboloidal mirrors 12 inches in diameter are described. The furnace was constructed for use in conjunction with an American Optical Company microscope having a working distance of 7.25 inches and a numerical aperture of 0.1. The maximum irradiance in the image was determined by (1) calculation from the optical system parameters, (2) photometry, and (3) observation of the stability of materials of known melting points. Calculations show that the theoretical maximum irradiance in the image is 3.8 watts/mm^2. Experiments indicate that the actual maximum irradiance in the image is 2.1 watts/mm^2; a flux density equivalent to the radiation from a black-body at 2200°C. The value of the equipment for microscopy studies was demonstrated by recording on movie film the behavior of uranium dioxide and mixtures of uranium dioxide with silicon or silicon carbide at high temperatures. Selected photographs from the movie film are included in this report. Stereomicrographs taken at room temperature show additional detail in the heated samples. Suggestions are made for further improvement of the furnace. (auth)

18099 HW-59383(Rev.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
INTERIM REPORT ON CREEP CHARACTERISTICS OF ZIRCALOY-2. P. J. Pankaskie. Mar. 25, 1959. 15p. Contract W-31-109-Eng-52. $0.50(OTS).

Annealed Zircaloy-2 exhibits very large primary creep strains. Primary creep appears to be sensitive to stress and largely insensitive to temperature. The primary creep deformation of Zircaloy-2 in the 15% cold-worked condition appears to be roughly half that

observed in annealed Zircaloy-2. In cold-worked Zircaloy-2, primary creep appears to be sensitive to both stress and temperature. At 750°F, 15% cold-worked Zircaloy-2 appears to exhibit some recovery and annealing. At the lower temperatures, recovery appears to be minor. (auth)

18100 KAPL-M-GEG-12
Knolls Atomic Power Lab., Schenectady, N. Y.
REPORT OF PRELIMINARY STRESS-CORROSION CRACKING TESTS OF TYPE-347 STAINLESS STEEL CAPSULES CONTAINING SODIUM HYDROXIDE. G. E. Galonian and H. L. Tymchyn. June 18, 1959. 25p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

Stress corrosion cracking tests of Type-347 stainless steel were conducted at 636°F for periods up to 1800 hr with 1- and 4-m sodium hydroxide. A capsule specimen (consisting of 1-in. schedule 40-pipe and welding caps) containing the solutions was evaluated as a test to detect susceptibility to caustic cracking. Stressed U-bend specimens were also tested in the capsules. Eight out of eight capsules not stress-relieved after welding failed in the welds and welded regions by transgranular cracking in approximately 100 hr. Two out of four capsules with stress-relieved welds failed in a thin wall gage section at a stress level of about 22,000 psi. Corrosion in specimens exposed for 1425 hr was predominately intergranular. One out of eight U-bend specimens (not stress-relieved) failed. The results show that an as-welded capsule-type specimen containing 1- to 4-molal sodium hydroxide at 636°F is a satisfactory test for detecting susceptibility to caustic cracking. (auth)

18101 KAPL-M-GLC-5
Knolls Atomic Power Lab., Schenectady, N. Y.
EQUIPMENT FOR FATIGUE TESTS OF S3G FUEL CELL STRUCTURE SECTIONS. G. L. Cutler and S. Beitscher. June 12, 1959. 8p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

SAR core components required bend fatigue data on acute angle test sections removed from an S3G Zircaloy tube structure. The bend fatigue tester was modified so that the force applied to a specimen could be measured directly and recorded on a strain recorder. A dial indicator was used to measure deflection at the point of force application. (auth)

18102 KAPL-M-JWB-3
Knolls Atomic Power Lab., Schenectady, N. Y.
STATUS OF THE PREDICTION OF ACTIVITY BUILD-UP IN INCONEL SYSTEMS. John W. Bartlett. July 20, 1959. 40p. Contract [W-31-109-Eng-52]. $7.80(ph), $3.30(mf) OTS.

Test programs, data, and associated information required to obtain a reasonably reliable prediction of the rate of buildup of radiation dose rates resulting from deposited long-lived activity in Inconel systems are given. Current theories on mechanisms of crud activation and transport and influential parameters are discussed in detail, in order to emphasize the importance of system variables and the present lack of fundamental knowledge of these factors. Methods used to predict activity buildup are briefly outlined. Available data from all known sources are reviewed, and it is concluded that these data do not resolve any of the inherent uncertainties associated with attempts to use stainless steel data to predict activity buildup in an Inconel system. In general, then, it is felt that no estimate of precision could be attached to a prediction of Inconel activity buildup which is based on data and information now available. (auth)

18103 KAPL-M-RA-4
Knolls Atomic Power Lab., Schenectady, N. Y.
AN INVESTIGATION OF B_4C-ZIRCALOY-2 SIZE DISTRIBUTIONS USING THE CINTEL FLYING SPOT PARTICLE RESOLVER. R. J. Allio, P. A. Oldow, and L. G. Wisnyi. July 6, 1959. 32p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Measurements of the size distribution of B_4C particles dispersed in a Zircaloy-2 matrix were performed with the Cintel Flying Spot Particle Resolver. The precision, accuracy, and sensitivity of the equipment were determined using artificial arrays of particles of known size. (auth)

18104 NAA-SR-3481
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HIGH-STRENGTH ZIRCONIUM ALLOYS. R. K. Wagner and H. E. Kline. July 15, 1959. 40p. Contract AT-11-1-GEN-8. $1.25(OTS).

The properties of zirconium alloyed with aluminum, tin, and molybdenum were investigated. Using reactor-grade zirconium sponge, 11 zirconium-base alloys were double arc-melted and cast into 6-in.-diam. ingots weighing 35 lb each. By such standard hot working procedures as extruding and rolling, the ingots were converted to ⅛-in.-thick strips. The extruded and rolled products were used for a variety of evaluation studies which included corrosion, thermal conductivity, tensile, and creep tests. The alloys demonstrated short-time elevated temperature strength properties equal to or greater than type-304 stainless steel. Their corrosion resistance in sodium, at 1000°F, compares favorable with that of unalloyed zirconium. The creep resistance and the thermal conductivity were found to be less than those for type-304 stainless steel, but adequate for nuclear reactor application. (auth)

18105 NACA-1392
Michigan. Univ., Ann Arbor.
BORON AND ZIRCONIUM FROM CRUCIBLE REFRACTORIES IN A COMPLEX HEAT-RESISTANT ALLOY. R. F. Decker, John P. Rowe, and J. W. Freeman. 1958. 40p. $0.40(GPO).

Supersedes NACA-TN-4049 and NACA-TN-4286.

The effects of the presence of small amounts of boron and zirconium in a titanium-and-aluminum-hardened nickel-base alloy were studied. Beneficial increases in high-temperature properties of the alloy were obtained by melting in magnesia or zirconia crucibles. Effects similar to those obtained by release of boron and zirconium during crucible-melt reactions were obtained by the intentional additions of boron and zirconium. These additions prolonged the life to fracture and permitted more deformation before fracture. Development of structural changes through the creep process is illustrated by optical and electron photomicrographs. (auth)

18106 NASA-TN-D-6
Michigan. Univ., Ann Arbor.
VACUUM-INDUCTION, VACUUM-ARC, AND AIR-INDUCTION MELTING OF A COMPLEX HEAT-RESISTANT ALLOY. R. F. Decker, John P. Rowe, and J. W. Freeman. Aug. 1959. 44p.

The relative hot-workability and creep-rupture properties at 1,600°F of a complex 55Ni–20Cr–15Co–4Mo–3Ti–3Al alloy were evaluated for vacuum-induction,

vacuum-arc, and air-induction melting. A limited study of the role of oxygen and nitrogen and the structural effects in the alloy associated with the melting process was carried out. (auth)

18107 NMI-4700
Nuclear Metals, Inc., Cambridge, Mass.
PROGRESS REPORT TO HANFORD ATOMIC PRODUCTS OPERATION [FOR] DECEMBER 15, 1956 THROUGH MARCH 15, 1957. H. F. Sawyer. Apr. 30, 1957. Decl. June 8, 1959. 14p. Contract AT(30-1)-1565. $3.30(ph), $2.40(mf) OTS.

The production of Zircaloy-2 clad U fuel elements, with integral end seals, by the coextrusion process is presented. These elements will be in 12 inch by 36 inch lengths, each with 0.020-inch and 0.030-inch cladding. The fuel element diameter is 0.630 inch. (W.L.H.)

18108 NP-7741
Syracuse Univ., N. Y. Research Inst.
MATERIALS IN SPACE ENVIRONMENT. Proceedings of the Fifth Sagamore Ordnance Materials Research Conference Conducted at Sagamore Conference Center, Racquette Lake, New York, September 16, 17, 18 and 19, 1958. 375p. Contract ROD-30-115-ORD-947. (MET-597-596).

Papers were presented on the following subjects: space environment and vehicle requirements; physics of space vacuum and effects on materials; thermal problems under orbiting conditions; radiation and radiation effects in outer space; and implications of space environment for material development. (W.L.H.)

18109 NP-7758
Naval Propellant Plant, Indian Head, Md.
METHODS FOR PREPARING SMALL PARTICLES OF METALS AND SALTS. Abraham Rotkowitz. Dec. 3, 1958. 19p. (MR-156).

Current techniques for production of submicron particles are reviewed in the light of their applicability to certain salts and metals. For salts, two methods, precipitation and spray drying, are the most feasible. For metals, a method involving vaporization and condensation seems best. (auth)

18110 NP-7771
California. Univ., Berkeley. Minerals Research Lab.
THE THERMODYNAMICS OF BISMUTH-LEAD ALLOYS. Technical Report No. 2 [for] January 1, 1959 to March 31, 1959. Prodyot Roy, Raymond L. Orr, and Ralph Hultgren. June 15, 1959. 33p. Project No. DA-599-01-004, Contract DA-04-200-ORD-171.

Heats of formation of six bismuth-lead alloys at 400°K were measured in a liquid lead solution calorimeter. A complete evaluation of the thermodynamic functions in the solid beta and epsilon phases is presented. The heat contents of four alloys have been measured in the diphenyl ether calorimeter verifying the validity of Kopp's law for these alloys. The phase diagram was critically studied and corrected at the solid phase boundary between epsilon and epsilon plus beta phases. (auth)

18111 NP-7777
Office of Ordnance Research, Durham, N. C.
CONFERENCE ON RESEARCH IN PROGRESS ON TUNGSTEN HELD IN DURHAM, N. C., MAY 20-21, 1959. 121p.

The papers presented at this conference included: Bureau of Mines Tungsten Program; Impurity Analysis in Tungsten; Tungsten and Some of Its Alloys; Electron Beam Melting; Phase Equilibria in Refractory Metals; Constitution of Tungsten and Tantalum Base Ternary Alloys; Research on Molybdenum-Tungsten, Pure Tungsten, and Tungsten-base alloys; Tungsten-Tantalum Alloy Development; Tungsten Alloy Development; Arc Casting, Purification, and Fabrication of Tungsten; Mechanical Properties of Tungsten; Arc Melting and Fabrication of Tungsten; The Effect of Impurities on the Properties of Tungsten; Ductility of Re-Mo and Related Refractory Alloys; NASA Research on Tungsten and Tungsten Alloys; Work of JPL; Effect of Selected Rare Earth Additions on the Removal of Interstitials from Tungsten and Molybdenum; Research on Forgeable Refractory Alloys of Tungsten, Tantalum, Molybdenum, and Columbium; The Potential of In-fab for the Conversion of Tungsten; Tungsten Research; Studies of Tungsten Coatings; Flame Spraying Tungsten with Gas Stabilized Arc; A Preliminary Study of the Protection of Tungsten by Coating of Rhodium; Fundamental Study of the Oxidation of Tungsten; Oxidation of Tungsten; The High Temperature Oxidation of W-Cb Alloys; and Research-in-Progress on High Purity Tungsten. (W.L.H.)

18112 NP-7810
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
AN X-RAY STUDY OF THE GRAPHITIZABILITY OF COKES OBTAINED FROM PYROLYSIS OF NAPHTHALENE VAPOURS. Report No. 81/I-B. A. Grossman, Z. Szmid, and M. Szudek. May 1959. 13p.

Naphthalene vapors were pyrolyzed at various temperatures, and the cokes obtained graphitized. X-ray studies showed that the degree of graphitization of the cokes is independent of the temperature of pyrolysis. (auth)

18113 NYO-8749
[Princeton Univ., N. J. Project Matterhorn.]
THEORY OF DISSIMILAR TUBULAR SEALS OF GLASS, CERAMICS AND METALS FOR CRITICAL APPLICATIONS. Publication No. 13. G. Lewin and R. Mark. [1957]. 29p. $4.80(ph), $2.70(mf) OTS.

An analysis of three types of seals based on general shell theory is presented. Included is stressing information and other factors concerning multiple graded glass seals, minimum length Kovar tubes welded to high expansion metal flanges, and ram seals consisting of ceramic cylinders with metal cylinders of different thermal expansion forced over the ends. The seal types are treated mathematically. (J.R.D.)

18114 SC-4306(TR)
Clevite Research Center, Cleveland.
PIEZOELECTRIC CERAMIC MATERIALS. Final Report [for] February 1, 1958 to January 31, 1959. Don Berlincourt. Apr. 27, 1959. 95p. Project No. 30146. For Sandia Corp. Contract [AT(29-1)-789]. $2.50 (OTS).

This research was in the field of piezoelectric ceramics and was concerned with lead titanate zirconate, modified lead titanate, lead stannate-lead titanate, and lead metaniobate. Subjects of this study include dielectric strength, thermal expansion and thermal conductivity, response to high unidirectional and hydrostatic stress, and crystal growth. (auth)

18115 SCTM-80-55(16)
Sandia Corp., Albuquerque, N. Mex.
CASTABILITY OF ALUMINUM ALLOYS. M. M. Karnowsky. Apr. 18, 1955. 12p. $1.80(ph), $1.80(mf) OTS.

A spiral mold, where the length of the spiral meas-

ures castability in sand molds, was employed to evaluate the four commonly used aluminum alloys. The pouring temperature exerted the greatest effect and can serve to suggest an alloy and temperature for a particular section to be poured. Effects of degassing the metal, moisture content of the sand, and "whistle" venting were insignificant in this mold. (auth)

18116 SEP-168

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

PREPARATION AND CONSOLIDATION OF THORIUM AND THORIUM HYDRIDE POWDERS. R. B. Wagner and S. Storchheim. Aug. 9, 1954. Decl. Jan. 20, 1956. 38p. Contract AT-30-1-GEN-366. (DCF-4896). $6.30 (ph), $3.00 (mf) OTS.

A study was made of powder characteristics and cold compacting properties of metallic thorium, Th_2, and Th_4 powders produced from Ames billet lathe turnings. In addition, a preliminary study was made of the influence of various powder processing and sintering variables on some physical properties of cold compacted bodies. The cold compacting and sintering characteristics of metallic thorium powder were generally superior to those of the hydride powders. The thorium powder could be cold compacted at 75 tsi to 96% of theoretical Ames billet density and sintered to 99% of the billet density when heated to above 1250°C for one-half hour. A test bar made from cold compacted and sintered thorium powder was found to have an ultimate tensile strength of 45,200 psi and an area reduction of 38.5%. (auth)

18117 WADC-TN-58-241

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF PROTECTIVE COATINGS FOR MOLYBDENUM NOZZLE GUIDE VANES. [Period covered]: January 1954 to July 1957. John R. Giancola. Feb. 10, 1958. 45p. Project title: METALLIC MATERIALS. Task title: REFRACTORY METALS. (AD-215442).

Thirty seven Mo nozzle guide vanes coated for resistance to jet engine operating conditions were evaluated in an engine exhaust stream at 1860-1890°F for 4 hours. Non-destructive and metallographic examinations revealed the degree of deterioration of each type of coating after test. Results indicate that, in the temperature range of the test, multilayer electrodeposited metallic coatings have the longest service life. No one coating combination survived the test without some serious damage. All coatings tested increased the life of the guide vanes over unprotected Mo. (auth)

18118 WADC-TR-57-294(Pt. I)

General Electric Co. Light Military Electronic Equipment Dept., Schenectady, N. Y.

RESEARCH ON LIQUID METALS AS POWER TRANSMISSION FLUIDS. [Period covered]: May 1956 to May 1957. Richard H. Blackmer. Feb. 17, 1958. 100p. Project and task title: HYDRAULIC FLUIDS. Contract AF33(616)-3698. (AD-151001).

The eutectic alloy of sodium (23 weight-percent) and potassium (77 weight-percent), known as NaK 77, has been determined from a technical survey of liquid metals and salts as the most feasible liquid known for 10 to 1000°F hydraulic system applications. A single cylinder test pump in an inert atmosphere glove-box has pumped NaK-77 up to 3600 psi at 100°F and up to 2000 psi at 1000°F. A total of about 100,000 cycles at 1 cycle per second and an average pressure of 1500 psi have been accumulated. Results of literature survey, consultation, and laboratory tests are included in this report. (auth)

18119 WADC-TR-58-5(Pt. II)

National Bureau of Standards, Washington, D. C.

COATINGS OF NICKEL–ALUMINUM ALLOYS PREPARED BY ELECTROLYSIS. Period Covered: January 1958 to January 1959. Dwight E. Couch and Jean H. Connor. Dec. 31, 1958. 44p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-57-10. (AD-214424).

Nickel–aluminum alloy coatings were produced by electrodeposition of aluminum over nickel. The aluminum was plated from baths operated at from 25 to 1000°C. Attempts to codeposit the two metals were not successful. The alloy was superior to nickel in salt spray tests, outdoor exposure tests, and in oxidation tests. (auth)

18120 WADC-TR-58-12(Pt. II)

Illinois. Univ., Urbana.

HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE. Period Covered: February 1958 to January 1959. Clifton G. Bergeron, Arthur L. Friedberg, David L. Wilcox, Paul F. Schwarzlose, and Robert L. Hallse. Jan. 1959. 54p. Project title: ELECTRICAL AND ELECTRONIC MATERIALS. Task title: ELECTRICAL AND ELECTRONIC INORGANIC MATERIALS. Contract AF33 (616)-3943. (AD-214700). OTS.

Further work on processing of coatings, coating continuity, multiple coating, formulation of coatings, oxidation of copper coated articles, high temperature electrical properties of coatings, and flexibility of coated wire are described. The technique of flow coating continuously moving wire through a procelain enamel proved to be a practicable and successful technique for coating. Multiple coating secured insulation continuity. It was shown from studies on oxidation of coated copper specimens that copper oxide dissolved in the coating is not deleterious but rather beneficial to the high temperature electrical properties. (auth)

18121 WADC-TR-58-13(Pt. II)

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

HIGH-TEMPERATURE INSULATION FOR WIRE. Period covered: February 1, 1958 to January 31, 1959. J. N. Harris and J. D. Walton. Apr. 7, 1959. 40p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-3944. (AD-216362).

Aluminum was plated and subsequently anodized on substrates of copper, chrome, iron, and Inconel. Efforts to anodize aluminum plated over various layer metals on copper were unsuccessful. Frit-silicone resin compositions were applied to anodized wire in separate steps, and electrical properties of frit-resin coatings applied to anodized wire were determined. Colloidal silica was deposited electrophoretically on anodized aluminum as a possible substitute for frit-resin coatings. Work on a "one time at temperature coating" showed possibilities of continuous operation to 900°F. (auth)

18122 WADC-TR-58-615(Pt. II)

A COMPENDIUM OF CONSTITUTIONAL TERNARY

DIAGRAMS OF THE METALLIC SYSTEM.
W. Guertler. Mar. 26, 1959. 85p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF61(052)-74. (AD-215427).

A collection of binary and ternary phase diagrams of various metallic systems is presented. The ternary diagrams are based on available binary diagrams. In each instance the most reliable binary diagram was selected. (auth)

18123 WADC-TR-58-646
Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
ZIRCONIA: ITS CRYSTALLOGRAPHIC POLYMORPHY AND HIGH TEMPERATURE POTENTIALS. Berthold C. Weber and Murray A. Schwartz. [Issued] July 1958. 25p. Project 7022. (AD-206908; PB-151665). $0.75(OTS).

Presented at the Fifth Annual ARDC Science and Engineering Symposium held on July 22-23, 1958 at Andrews AFB, Washington, D. C.; Also published in German in Ber. duet. keram Ges. 34, 391-6(1957).

Zirconia (ZrO_2), with a melting point of 2680°C (4850°F) is one of the more promising materials for high temperature applications. Its usefulness is significantly dependent on controlling its crystallographic transformations. Experiments conducted in the Aeronautical Research Laboratory have clarified some of the controversial data presented in the literature. Future potentials for ZrO_2-base materials for high temperature structural and corrosion-resistance applications are described. (auth)

18124 WADC-TR-59-10(Pt. I)
Carborundum Co., Niagara Falls, N. Y.
DEVELOPMENT AND EVALUATION OF MATERIALS FOR HIGH TEMPERATURE APPLICATIONS. [Period covered] February 1, 1958 through January 31, 1959. Charles E. Shulze, Frank A. Saulino, William T. Adams, Gustave E. Mangsen, James C. Andersen, and Howard W. Emmons. Mar. 1959. 58p. Project title: DEVELOPMENT AND EVALUATION OF MATERIALS FOR HIGH TEMPERATURE APPLICATIONS. Task title: ICBM MATERIALS. Contract AF33(616)-5542. (AD-214427).

Various preparational techniques have been used to fabricate graphite-based bodies which have potential resistance to high-velocity, high-temperature air. Materials have been evaluated in a high-intensity arc testing facility. Results are reported. At least ten compositions have been developed which are superior to either AGKSP graphite or to a graphite–silicon carbide body on the bases of tests imposed. (auth)

18125 WADC-TR-59-88
Commonwealth Engineering Co. of Ohio, Dayton.
DEVELOPMENT OF A METHOD TO ACCOMPLISH ALUMINUM DEPOSITION BY GAS PLATING. Period covered: June 16, 1958 through December 16, 1958. Malvern J. Hiler and William C. Jenkin. Apr. 20, 1959. 62p. Project title: MATERIALS APPLICATIONS. Task title: MATERIALS PRODUCT DEVELOPMENT. Contract AF33(616)-5594. (AD-214887).

The deposition of Al was accomplished by thermally decomposing vapors of tri-isobutyl aluminum on the surface of cleaned, heated copper test panels in a heated plating chamber. The test panels were subjected to a preliminary deoxidation by induction heating to 800°F in a H atmosphere, purging the chamber with argon gas while cooling the sample to 500°C, then admitting a mixture of gases containing tri-isobutyl aluminum vapors for varying periods. The plate produced is substantially pure aluminum, lustrous and ductile, of excellent conductivity, and in thickness up to 4.7 mils. Adhesion varied from poor to excellent. (auth)

18126 WAL-TR-312/80
Watertown Arsenal, Mass.
FORGING EFFECTS ON THE MECHANICAL PROPERTIES OF THREE BORON-TREATED STEELS. Eugene DiCesare. July 1959. 48p. DA Project 5B93-32-002. (PB-151814). $1.25(OTS).

Steel alloys 14B35, 14B50, and 10R70 containing boron and rare earths were hot forged (2250°F) by upsetting and drawing out (swaging) with reduction ratios up to 8 to 1 and 13 to 1, respectively. Longitudinal and transverse tensile and Charpy specimens, and micro and macrospecimens were tested and examined in the as-forged and in the heat-treated condition. Heat treatment resulted in optimum tensile properties and toughness in both the upset-forged and the drawnout, or swaged, ingots, at approximately 66% reduction for the swaged ingots, 50% reduction for the upset-forged 14B35 alloy, and 0% reduction for the upset-forged 14B50 and 10R70 alloys. (auth)

18127 WAL-TR-711-2/1
Watertown Arsenal Lab., Mass.
BALLISTIC EVALUATION OF NICKEL STEEL PLATE AT LOW TEMPERATURE. Charles W. Amos. July 1959. 14p. DA Project 5B93-32-005.

Two $\frac{3}{8}$"-thick 9% nickel steel alloy plates that conform to ASTM A353 alloy steel were subjected to ballistic shock impact with yawed caliber .50 AP M2 projectiles at a temperature of −165°C. The limited ballistic tests indicated that this special nickel steel exhibited good ballistic shock properties at considerably lower temperatures than those where brittle behavior occurs with heat-treated steels of the types employed for standard homogeneous steel armor, and at much lower temperatures than where brittle behavior occurs with low alloy high strength structural steels. (auth)

18128 WAPD-EM-16
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
STRESS VARIATIONS IN A ZIRCONIUM CYLINDER CAUSED BY THERMAL CYCLING. D. D. Frederick. Oct. 12, 1950. Decl. June 1, 1959. 15p. Contract AT-11-1-GEN-14. $3.30(ph), $2.40(mf) OTS.

A method was devised to thermal cycle a hollow zirconium cylinder between two values of stress which correspond to the stresses in the fuel plate cladding when the reactor is operating at full load and twice full load. The cylinder is heated on the outer surface by the induction coil of a 5 kw, 450 kc radio-frequency generator, while the inner surface is cooled by circulating water through the hole at a constant rate of flow as measured by a flowmeter. The cylinder is cycled by using a Wheelco Multronic Capacitrol three point controller which changes the power settings of the generator from high to low power to produce the two levels of stress. The time for one cycle is approximately one and one-half minutes. Copper-constantan thermocouples are used throughout to measure the temperature distribution through the wall, along the outer surface of the cylinder and the temperature rise of water flowing through the cylinder. The inner surface of the cylinder was in-

spected visually every 500 cycles, and after 10,000 cycles no cracks or dimensional changes were observed. (auth)

18129 WAPD-PWR-PMM-1207
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. PWR ALTERNATE CONTROL ROD MATERIAL PROGRAM. Monthly Report No. 10 for March 15 to April 15, 1957. I. Cohen. Apr. 15, 1957. Changed from OFFICIAL USE ONLY June 25, 1959. 44p. $7.80 (ph), $3.30 (mf) OTS.

A number of Ag–In–Cd alloys was prepared for evaluation as possible control rod material. The physical properties, corrosion resistance, fabricability, structure, and physics worth of these alloys are reported. (D.E.B.)

18130 AEC-tr-3660
A CONTRIBUTION TO THE STUDY OF NUCLEAR FUELS DERIVED FROM METALLIC URANIUM. (Contribution a l'Etude des Materiaux Combustibles Nucléaires a Base d'Uranium Métallique.) Marcel Englander. Translated from report CEA-776, 1958. 106p. $2.50 (OTS).

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4760.

18131 AEC-tr-3773
POROUS MEMBRANES AND PROCEDURES FOR THE MANUFACTURE OF THE MEMBRANES. Translated by A. S. Berman (Union Carbide Nuclear Corp. K-25 Plant) from French Patent No. 1-172.527. [Patent] Granted; Oct. 20, 1958. 6p. $1.80 (ph), $1.80 (mf) JCL.

The fabrication of diffusion barriers with high resistance to chemical corrosion is described. A metallic gauze, resistant to corrosion, is covered with flocculated teflon emulsion. The gauze is then processed through treatments to fix the emulsion and remove the coagulant. (J.R.D.)

18132 CEA-tr-R-61[illegible]
ETUDE DE LA NATURE DE LA PASSIVITE LOCALE DANS LE POLISSAGE ELECTROLYTIQUE DU CUIVRE PAR LA METHODE DES COURBES DE CHARGE. (Study by the Charge Curve Method on the Nature of the Local Passivity in the Electrolytic Polishing of Copper.) G. S. Vozdvizhenskii (Vozdvijensky) and A. I. Turachev (Tourachev). Translated into French from Doklady Akad. Nauk S.S.S.R. 114, 358-60 (1957). 8p.

The formation of oxide films on the surface of copper during its electrolytic polishing in a solution of phosphoric acid is studied by application of the method of anodic charge curves with oscillographic recording. The anodic curves show a long initial stage in which the potential varies only from 0.48 to 0.52 v. The second stage is characterized by a rapid change in potential which ends in a sudden leap to 0.88 v. After the leap there is a short period during which the potential does not increase. Then a very rapid increase begins and continues up to the release of oxygen at 1.75 v. In the first stage no electrolytic polishing is possible, and it is in this stage that initial oxidation processes to cuprous oxide begin. The second stage, characterized by a rapid potential increase, is explained by the electrochemical oxidation of the surface. The oxide which is formed causes the leap of the potential to the value which permits the formation of cupric oxide, which is shown by the stopping of potential increase. This mechanism was confirmed by the analysis of anodic curves made in the presence of various additives such as glycerine, potassium hypophosphite, and chromium trioxide. (J.S.R.)

18133 CEA-tr-R-622
ETUDE DES ALLIAGES DE MAGNESIUM AVEC DIVERS METAUX DES TERRES RARES. (Study of Magnesium Alloys with Various Rare Earth Metals.) N. M. Tichov and L. A. Afanassiev. Translated into French from Metalloved. i Obrabotka Metal. 3, 38-41 (1958). 11p.

The mechanical properties of magnesium alloyed with lanthanum, cerium, praseodymium, or neodymium were investigated. The mechanical resistance at high temperatures was measured, and the results are tabulated. The tabulation shows that the resistance varies in a quite irregular fashion from one alloying element to the next. The solubility of the rare earths in magnesium at the tempering temperatures, the parameters of the crystalline lattice, and the diffusion in magnesium were determined. In comparison with the other rare earths neodymium improves the mechanical properties best. The high mechanical resistance seems to be based on the high solubility of neodymium and its lower diffusion in magnesium. (J.S.R.)

18134 CEA-tr-R-681
HETEROGENEITE DE LA ZONE DE FUSION DES JOINTS DE SOUDURE. (Heterogeneity of the Fusion Zone of Welded Joints.) L. S. Livshits (Livshitz), L. P. Bakhrakh, and S. I. Panich. Translated into French from Metalloved. i Obrabotka Metal., No. 1, 26-9 (1958). 12p.

In the arc welding of steels a heterogeneous structure is often observed in the fusion zone, and frequently the weld border has a chemical composition which is different from that of the base metal. The influence of manganese on this heterogeneity of structure and composition was studied in carbon steels. In welded joints in perlitic steel the formation of a chemical and structural heterogeneity, which is characterized by the creation of decarburated and subcarburated zones, is possible. The heterogeneity comes from the diffusion of carbon atoms from one zone of the weld to the other. The diffusion is from the zone containing elements giving the least stable carbides into the zone containing elements forming the most stable carbides. For example, the carbon of the base metal is bound to the stable complex carbides of chromium or molybdenum rather than to the less stable iron and manganese carbides. The carbon displacement is determined by the qualitative and quantitative difference in the content of elements forming stable carbides. The welded joint, immediately after welding, does not always have a heterogeneous zone. Ordinarily it appears only after thermal treatment a little below some critical temperature. (J.S.R.)

18135 JPRS-DC-364
A STUDY OF THE EFFECT OF GASES ON THE DENSITY OF A LAYER OF POTASSIUM ETHYL XANTHOGENATE OF THE SURFACE OF GOLD, SILVER, COPPER AND THEIR ALLOYS BY MEANS OF RADIOACTIVE ISOTOPES. I. N. Plaksin and S. P. Zaitseva. Translated from Met. Isvet. Metal., No. 26, 21-32 (1957). 16p. $0.50 (OTS).

Sulfur-35 introduced into the composition of the flotation reagent, potassium ethyl xanthogenate, was used in a study of the reaction of flotation reagents with the surface of minerals. The effects of the surrounding atmosphere on changes in the density of the absorption

layer were studied in pure gold, silver, and copper and in two- and three-component alloys. (C.H.)

18136

THEORY OF ORDER IN Fe_3Al ALLOY. Kazimierz F. Wojciechowski (Wrocław Univ., Poland). Acta Phys. Polon. 18, 15-20(1959).

A statistical theory of order-disorder transitions in the Fe_3Al alloy is presented which enables one to take into account the interactions of atoms from farther neighborhoods and thus to determine more accurately the transition temperature from order to disorder. It is shown that the interaction energy of third neighborhood is approximately $\frac{1}{2}$ of the interaction energy of the second one. (auth)

18137

ON DISACCOMMODATION EFFECT IN NICKEL. Janusz Morkowski (Polish Academy of Sciences, [Warsaw]). Acta Phys. Polon. 18, 75-9(1959).

Apparatus described previously was used to measure reversible permeability under compressive stress. Momentary values were obtained from the e.m.f. induced in secondary coils of mutual inductances when a bridge was balanced. The measurements were made on long cylinders of polycrystalline Ni (0.82% Mg, 0.21% Fe, 0.08% Cu, and 0.10% Si) annealed in H_2 at 1000°C for 2.5 hr and cooled to room temperature at 12°/min. A time decrease of reversible permeability after demagnetization or stressing was observed. (T.R.H.)

18138

THORIA REINFORCED BY METAL FIBERS. Y. Baskin and C. A. Arenberg (Armour Research Foundation, Chicago) and J. H. Handwerk (Argonne National Lab., Lemont, Ill.). Am. Ceram. Soc. Bull. 38, 345-8(1959) July.

Thoria compacts containing refractory metal fibers in quantities as low as five per cent have considerably better resistance to thermal shock spalling than thoria alone. Of the metals and alloys investigated, molybdenum and niobium gave the best results. Compacts incorporating fibers of these metals have lower elastic moduli and compressive strengths and higher thermal conductivity than thoria. Oxidation resistance of molybdenum fiber-reinforced thoria is the best of all combinations investigated, but, owing to the presence of microcracks, it is severely attacked after prolonged exposure to an oxidizing atmosphere at 1000°C. (auth)

18139

APPLICATIONS OF SPECIAL REFRACTORIES IN THE ALUMINUM INDUSTRY. R. W. Brown and C. R. Landback (Carborundum Co., Perth Amboy, N. J.). Am. Ceram. Soc. Bull. 38, 352-60(1959) July.

Specific properties of ceramic- and nitride-bonded silicon carbide, fused-cast alumina, and high-temperature, ceramic-fiber products are related to applications within the aluminum industry. These properties indicate a new field of usage for bonded- and fused-cast refractories in reduction cells. Application for these and other materials also includes crucible and furnace linings, as well as special refractory parts designed to transport and meter molten aluminum. (auth)

18140

WELDING AND THE NUCLEAR POWER PROGRAMME. Atom No. 32, 22-35(1959) June.

The welding processes of metals, both ferrous and non-ferrous, are discussed in relation to the Calder Hall type reactor, the advanced gas-cooled reactor, and the fast fission breeder reactor. Various inspection methods are given. (C.J.G.)

18141

HEAT RESISTANT MATERIALS. DEVELOPMENTS IN THE PRODUCTION OF CHROMIUM. Atomics and Energy 4, 686-90(1959) May (Suppl. to Ind. Rev. Africa 10, No. 11, (1959) May).

Chromium and chromium-rich alloys, because of their high melting points, are being investigated for possible uses in engines requiring heat-resistant materials. A comparison of chromium with other metals used in heat-resistant alloys and an analysis of various chromium ores throughout the world are tabulated. Preparation methods, specifically electrolysis of solutions of chromic and sulfuric acid, chromite leaching process, ferrochrome process, and electrolysis are discussed. (C.J.G.)

18142

COATED POWDERS PROVIDE UNIQUE MATERIALS. Joseph H. Oxley and John M. Blocher, Jr. (Battelle Memorial Inst., Columbus, Ohio). Battelle Tech. Rev., 8(1959) July.

The combination of vapor deposition and fluidized-bed techniques has made available a wide variety of coated-powder combinations for structural and other purposes. Methods of producing such powders and their potentialities in nuclear technology, aircraft construction, and catalytic processes are discussed. (C.J.G.)

18143

HARDFACING WITH COBALT-BASE ALLOYS. G. Grainger. Cobalt, No. 3, 3-15(1959) June.

Composition and properties of Stellite grades 6, 12, and 1 are presented. Deposition of the alloys is discussed as to technique and feasibility. Problems of hardfacing are discussed in relation to choice of base metal and welding stresses. Industrial applications of the alloys are presented. (C.J.G.)

18144

APPLICATION OF DISPERSION HARDENING TO COBALT. Earl F. Adkins and Robert I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). Cobalt, No. 3, 27-30 (1959) June.

It was established that the high-temperature creep resistance of cobalt is considerably increased by additions of certain oxide dispersions. All of the ten cobalt-oxide alloys evaluated exhibited substantial increases in 500°C creep strength. The strongest composition was Co–1.0 Cr_2O_3, which showed only 4% of the total creep elongation of pure cobalt after 250 hours at 500°C and 12,000 psi (8.4 kg/mm^2) stress. Oxide particle size was found to be an important factor in obtaining oxide-dispersion strengthening. Of all alloys evaluated those containing the finest dispersions also had the highest room-temperature and elevated-temperature properties. Cobalt–chromium base powder metallurgy alloys containing intrinsic Cr_2O_3 dispersions exhibited improved tensile and creep properties over those of pure cobalt. The high-temperature creep resistance of a powder metallurgy alloy of L-605 composition, however, was much lower than that of L-605 commercially produced by melting methods. (auth)

18145

A DILATOMETRIC STUDY OF GALLIUM AT ATMOSPHERIC PRESSURE. André Defrain and Israël Epelboin. Compt. rend. 249, 50-2(1959) July 6. (In French)

In thermal analysis studies of Ga a solid phase was found which was unstable at atmospheric pressure and had a melting point of −17 ± 1°C. Dilatometric studies of this phase are described. (T.R.H.)

18146

EFFECTS OF SMALL ADDITIONS OF COPPER ON THE RECRYSTALLIZATION OF ALUMINUM PURIFIED BY ZONE MELTING. Omourtague Dimitrov. Compt. rend. 249, 265-7(1959) July 15. (In French)

A study of the recrystallization of very pure Al and Al alloys containing very small amounts of Cu is described. The Al purified by zone melting contained only about 10 ppm impurities; the amounts of Cu added (0.36 to 120 ppm) were controlled by activation analysis. The samples were rolled in liquid N_2 to a 97% reduction, then isothermally annealed for increasing times at temperatures from −38 to +87°C. After electrolytic polishing and anodic oxidation at low temperature, they were micrographed in polarized light. The electric resistivity at liquid H_2 temperatures was measured during the recrystallization anneals. The Cu effect was very different for germination and for growth of new grains in the interior of the cold-worked metal. The intervention of a restoration phenomenon for samples containing 5 to 120 ppm Cu was observed which is not found in pure Al. (T.R.H.)

18147

DEMONSTRATION OF TWO REGIONS OF TRANSITORY FRAGILITY IN ALUMINUM−ZINC ALLOYS AT HIGH ZINC CONCENTRATIONS. Pierre Gobin and Jean Montuelle. Compt. rend. 249, 271-3(1959) July 15. (In French)

The study, as a function of time, of the mechanical properties of Al−Zn (12% Zn) after thermal treatment shows the existence of two regions of transitory brittleness. The first occurs several hours after heating, the second, several days. (tr-auth)

18148

NIOBIUM RECRYSTALLIZATION DIAGRAM. E. M. Savitskii, V. V. Baron, and K. N. Ivanova (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 771-3(1959) June 1. (In Russian)

The recrystallization temperature of arc-cast niobium and the effects of 10 alloying elements (Cr, B, Mo, Si, Ta, Ti, V, W, Zn, and Zr) on recrystallization were studied. The recrystallization diagram indicated that thermo-mechanical treatment at 1100 to 1450°C with deformation above 10% produces fine-grain niobium with uniform structure. (R.V.J.)

18149

CATHODE POLARIZATION ON THE DEPOSITION OF VANADIUM FROM OXIDE MELTS. V. I. Musikhin, O. A. Esin, and B. M. Lepinskikh (Inst. of Metallurgy, Ural Section of the Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 1037-40(1959) June 11. (In Russian)

Electrolytic deposition of vanadium on liquid iron cathodes in molten calcium aluminate containing V_2O_2 was discussed in previous works. Studies were made of cathode polarization in order to determine the limiting stages and the charge of discharging ions. A liquid Fe−V alloy cathode and a Pt wire anode were treated in oxidized atmosphere at 1550 to 1570°C. The polarization curves obtained in Al_2O_3−CaO−MgO (50.0, 42.5, and 7.5%, respectively) and Al_2O_3−CaO−MgO−SiO_2 (25.0, 40.0, 7.0, and 28.0%, respectively) systems with admixtures of V_2O_2 are plotted. (R.V.J.)

18150

FURNACE FOR MELTING URANIUM. Pierre Pensa (l'Institut Electrotechnique, Grenoble, France). Énergie nucléaire 1, 85-93(1959) May-June. (In French)

A brief résumé of operations which permit going from U minerals to metal billets is followed by a discussion of the reasons for melting U in a vacuum: removal of dissolved gas, reduction of traces of oxides, purification of U, and the obtaining of pieces with precise dimensions and shape directly. A description is given of the prototype melting furnace. The crucible-molds are described in particular. The method of operation of the furnace and the results obtained are given. (tr-auth)

18151

RECRYSTALLIZATION OF NIOBIUM AND NIOBIUM ALLOYS. E. M. Savitskii, V. V. Baron, and K. N. Ivanova (Baikov Inst. of Metallurgy, Academy of Sciences, U.S.S.R.). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 11, 38-45(1958) Nov. (In Russian)

Studies were made of Nb recrystallization and the effects of alloying with Cr, Mo, La, Si, Ta, and Zr on recrystallization temperature, hardness, plasticity, and technological properties. (R.V.J.)

18152

ON DIFFUSION OF GOLD IN SELENIUM. V. G. Sidyakin (Polytechnic Inst., Kiev). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 11, 110-12(1958) Nov. (In Russian)

The effect of a gold electrode on the electrical resistance of a selenium sample were investigated at t = 180 and 80°C. (auth)

18153

HEAT CONDUCTIVITY OF INDIUM AND GALLIUM ARSENIDES AND INDIUM SELENIDE AND TELLURIDE. N. N. Sirota and L. I. Berger (Inst. of Physics and Tech., Belorussian S.S.R.). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 11, 117-20(1958) Nov. (In Russian)

The heat conductivity of polycrystalline samples of InAs, GaAs, In_2Se_3, and In_2Te_3 was measured in the temperature interval from 100 to 300°K. In a number of cases measurements were made up to 350°K. Samples of InAs and GaAs contained $\sim 10^{18}$ atoms/cm^3 of admixtures of Group III. Heat conductivity in the temperature interval investigated is a linear function of 1/T. The value of heat conductivity in the interval from 300 to 90°K changes for InAs from 12.7×15^{-2} to 21.6×10^{-2}, GaAs from 7.88×10^{-2} to 8.38×10^{-2}, In_2Te_3 from 6.06×10^{-3} to 9.2×10^{-3}, and In_2Se_3 from 2.5×10^{-3} to 4.3×10^{-3} cal/cm sec gr. (auth)

18154

HEAT RESISTANCE AND HARDNESS OF HIGHLY ALLOYED IRON−ALUMINUM ALLOYS. L. I. Shvedov (Inst. of Physics and Tech., Belorussian S.S.R.). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 12, 69-71(1958) Dec. (In Russian)

Results are given of hardness and relative heat resistance tests on iron−aluminum alloys of Ti, Mo, Nb, W, and Ni. It is shown that alloys of Fe−Al−Ti−Mo−Ni−W have a tendency for dispersional hardening and are highly heat resistant. Alloys of Fe−Al−Mo−Ti or Ni have good heat resistance and high chemical resistance. (auth)

18155

ELECTROCLAD ALUMINUM ON URANIUM. John G. Beach and Charles L. Faust (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 106, 654-9 (1959) Aug.

Electroplating of aluminum was studied at Battelle in 1953-55 as an alternative method for aluminum cladding of uranium fuel elements. Uranium electroclad with 12 mils of aluminum over a 0.5-mil nickel or nickel-plus-copper electroplate resisted corrosion for more than 100 hr in boiling water. Hot pressing the electroclad composite improved the corrosion resistance. Many of the results obtained with aluminum electrocladdings paralleled those obtained with wrought aluminum claddings on uranium. (auth)

18156

THE SOLID SOLUBILITY OF LITHIUM IN ALUMINIUM. W. R. D. Jones and P. P. Das (University Coll. Cardiff, Eng.). J. Inst. Metals 87, 338-40(1959) June.

The maximum solid solubility of lithium in aluminum has been found, by micrographic methods, to be 4.2 wt. % at the eutectic temperature just above 600°C; the solubility falls to 1.7 wt. % at 400°C and 0.4 wt. % at 200°C. (auth)

18157

RAM REACTOR PROVIDES CONTINUOUS ZIRCONIUM PRODUCTION. W. W. Dunham, Jr. and R. D. Toomey (National Lead Co., South Amboy, N. J.). J. Metals 11, 438-40(1959) July.

The ram-reactor process for producing zirconium or Zircaloy ingots is built around continuous reduction of zirconium tetrachloride and periodic compacting and withdrawal of the metal product in a form suitable for arc melting. A flow sheet is included, starting with $ZrCl_4$ and ending with finished ingot. Quality of zirconium ingot produced from this process is superior to any Kroll process material reported to date and is equivalent to crystal bar metal in ductility. Strips of sheet have been rolled from 0.062 to 0.001 in. without immediate annealing. Economical advantages of this process are discussed. (C.J.G.)

18158

ZIRCONIUM BY SODIUM REDUCTION. F. Weston Starratt. J. Metals 11, 441-3(1959) July.

The problems encountered in the processing of zirconium by sodium reduction, i.e., separation of zirconium from hafnium and corrosion in the lines, are discussed. (C.J.G.)

18159

ARGONNE OPENS PLUTONIUM FACILITY. J. Metals 11, 456-7(1959) July.

A discussion of the economic advantages and equipment in the fabrication area is given. (C.J.G.)

18160

WELDING UNUSUAL METALS. D. W. Grobecker (Sandia Corp., Albuquerque, N. Mex.). Metal Progr. 76, No. 1, 87-90(1959) July.

Methods of welding including electron beam welding, diffusion bonding, motor-arc welding, and combination methods are discussed. The successful welding and soldering of uranium in different shapes are discussed. (C.J.G.)

18161

ZIRCALOY—A NEW CORROSION PROBLEM. Nuclear Power 4, No. 39, 86(1959) July.

Severe localized corrosion of Zircaloy-2 in steam under pile irradiation is reported. Experimental procedures are given. (C.J.G.)

18162

A STUDY OF SOME MECHANICAL, PHYSICAL, AND CORROSION PROPERTIES OF IODIDE HAFNIUM. J. G. Goodwin and F. R. Lorenz (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 49-56 (1959) July.

Five 30-lb, 4-in.-diam iodide hafnium ingots representing material typical of that utilized for the Shippingport PWR were fabricated into strip. Typical tensile, impact, hardness, corrosion test weight gain, electrical resistivity, and chemical analysis values were obtained by testing samples from each strip. The effect of irradiation on the impact strength and hardness of hafnium strip was investigated by subjecting a total of 36 subsized Izod impact specimens to irradiation for two cycles in the MTR. A duplicate group of nonirradiated specimens was used as a control group. The mechanical, physical, and corrosion property measurements for the nonirradiated and irradiated samples showed no physically significant differences attributable to chemical analysis. The impact strength and hardness values for the irradiated specimens showed differences which were attributable to the integrated neutron flux received. (auth)

18163

EFFECT OF OXYGEN IMPURITIES AND ALLOYING ADDITIONS ON THE ELASTIC PROPERTIES AND INTERNAL FRICTION OF CHROMIUM. I. G. Polotskii, Z. L. Khodov, and G. I. Levin (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 116-21(1959) Jan.-Feb. (In Ukrainian)

The results of an investigation of the effect of oxygen impurities and alloying additions (Fe, Zr, and Be) on the elastic and inelastic properties of chromium and their dependence on the temperature are presented. The minimum of the modulus of elasticity and the anomalous change in the damping decrement on the curves representing the changes in the properties of chromium and its alloys with the temperature indicate the existence of low-temperature transformations in chromium and its alloys. The displacement of the minimum of Young's modulus towards the lower temperatures on adding zirconium to chromium is evidence of the dependence of the temperature transformation on the alloying additions. An increase in the oxygen content in chromium from 0.13 to 0.32 at. % causes a rise in the modulus of elasticity and a fall in the temperature at which there occurs a sharp increase in the damping decrement. The decrease in Young's modulus of the nickel–iron alloy indicates a weakening of interatomic bonds on adding iron to chromium. Addition of beryllium to chromium reinforces the interatomic bonds. A sharp increase in the damping decrement in the temperature region of 450 to 650°C is probably due to the beginning of viscous sliding along the boundaries of the grains. (auth)

18164

AN EVALUATION OF THE DIFFUSION-BONDING CHARACTERISTICS OF ZIRCALOY-2. W. Feduska (Westinghouse Electric Corp., East Pittsburgh, Penna.). Welding J., (N. Y.) 38, 289s-95s(1959) July.

Ten promising diffuser elements were used in experiments aimed at joining Zircaloy-2 components by a diffusion-bonding technique. Copper, nickel, nickel–phosphorus, manganese, and silicon appear most favorable for this purpose. (auth)

18165

PLASMA-ENERGY TRANSFER IN GAS-SHIELDED WELDING ARCS. H. C. Ludwig (Westinghouse Research Labs., Pittsburgh). Welding J., (N. Y.) 38, 296s-300s(1959) July.

High-current welding arcs are influenced by the self-magnetic field produced within the discharge acting to compress or pinch the conducting plasma. The thermal expansion of the plasma opposes the magnetic compression. The geometric form of the discharge is controlled by the interaction of these opposing forces. An axial pressure gradient occurs, occasioned by the magnetic compression when the radius of the plasma varies throughout its length. The magnetic pressure is proportional to the square of the current and varies inversely with the cross-sectional area of the plasma. The product of the plasma temperature, particle density and gas constant determines the opposing pressure of the gas expansion. The thermal conductivity which varies with the gas composing the plasma is an influential factor determining the radial temperature gradient and effective pressure of the arc. Arcs shielded by low-thermal-conductivity gases manifest the magnetic compression at lower current values than high-thermal conductivity gases. Those in the former group known to form readily a compressed plasma are xenon, mercury, and argon. Helium is representative of the latter group. The various modes of heat conduction comprising the total thermal-conductivity coefficient for several gases are described. The magnetic-pinching mechanism is analyzed and shown to be effective in assisting the transfer of metal through the arc. In the absence of the magnetic compression, metal transfers more slowly and less uniformly, constituting what is known as globular transfer. (auth)

18166

INSTANTANEOUS INSPECTION OF SHIP WELDS WITH SCATTERED GAMMA RADIATION. J. I. Bujes (Naval Ordnance Test Station, China Lake, Calif.). Welding J., (N. Y.) 38, 301s-4s(1959) July.

A filmless method utilizing only one side of the ship's hull during testing is presented giving principle and experimental arrangement. A cobalt-60 isotope was used as a source, and a scintillator was found to be most sensitive as a detector of the transmitted gamma radiation through the various points in the steel plate. It is noted that for ½ inch steel and detection of 4% defects only, about 700 mc of cobalt-60 for 20 hr of exposure and 1400 mc for 10 hr of exposure would be required. (C.J.G.)

18167

FABRICATION AND CONSTRUCTION OF PIPING SYSTEM FOR THE DRESDEN NUCLEAR POWER STATION. G. B. Grable and A. M. Croswell (Bechtel Corp., San Francisco). Welding J., (N. Y.) 38, 657-64(1959) July.

The unique service conditions in the 180,000-kw Commonwealth Edison Dresden Nuclear Power Station near Morris, Ill., required the use of special materials and fabricating procedures in its construction. The materials of fabrication, the forming, heat-treating, and welding procedures, and special techniques employed in the fabrication and construction of the power-piping system of the plant are described. (auth)

18168

INVESTIGATIONS IN THE TANTALUM–OXYGEN SYSTEM. I. THE MECHANISM OF THE OXYGEN ABSORPTION AT HIGH TEMPERATURES. Erich Gebhardt and Hans-Dieter Seghezzi (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 248-57 (1959) May. (In German)

The time dependence of reactions taking place when tantalum is loaded with oxygen was studied by measuring the amount of oxygen absorbed, the electrical resistivity, and the microhardness, and by investigating the structure and the microstructure of the specimens. It was found that in the temperature range between 700 and 1420°C the following three reactions may occur simultaneously: solution of oxygen in tantalum formation of an outer layer of Ta_2O_5, and formation of suboxide with laminated structure in the cubic planes of the tantalum. These reactions were investigated in detail, and the results are discussed. (auth)

18169

CONTRIBUTION TO THE STRUCTURE OF THE VANADIUM–BORON SYSTEM. Hans Nowotny (Universität, Vienna) and Friedrich Benesovsky and Richard Kieffer (Metallwerk Plansee Aktiengesellschaft, Reutte/Tirol, Austria). Z. Metallk. 50, 258-61(1959) May. (In German)

The vanadium–boron system was investigated with pressure-sintered normal-sintered, and molten specimens. Measurements of melting points, analysis of microstructure, and x-ray investigations were carried out to give a preliminary constitutional diagram. The compounds V_3B_2, VB, V_3B_4, and VB_2 were observed. Their melting points and hardness are relatively high. (auth)

18170

MARTENSITE IN TITANIUM ALLOYS. Ulrich Zwicker (Metallgesellschaft AG., Frankfurt am Main). Z. Metallk. 50, 261-8(1959) May. (In German)

The formation of martensite by deformation and aging at −70°C as well as its re-solution and regeneration were studied with the alloy TiV16Al3. The effect of the martensite upon age hardening and the influence of nonstable preparatory modifications of the α phase upon martensite formation and mechanical properties were investigated. The dependence of Young's modulus of martensitic titanium–molybdenum alloys on internal stresses and the effect of hydrogen and deformation upon Young's modulus of TiV16Al3 were also studied. The results are discussed. (auth)

18171

YIELD POINT IN ZIRCONIUM–TIN ALLOYS. Lothar Bangert (Fa. W. C. Heraeus GmbH., Hanau, Ger.). Z. Metallk. 50, 269-74(1959) May. (In German)

Measurements of tensile strength, total extension, and plastic flow at the yield point of Zircaloy-2 were performed after different heat treatments. The results indicate that the tendency towards embrittlement by age hardening and strain aging is extremely low at temperatures usual for power reactors. (auth)

18172

INFLUENCE OF THE ALLOYING ELEMENTS IRON AND SILICON ON THE TEXTURE AND EAR BEHAVIOR OF PURE ALUMINUM. Wolfgang Bunk and Paul Esslinger (Laboratorium der Aluminium-Walz- und Presswerke Julius & August Erbslöh, Wuppertal, Ger.). Z. Metallk. 50, 278-87(1959) May. (In German)

Texture and earing of pure aluminum strips with varying additions of iron and silicon were studied in different stages of processing. The results are compared with those of earlier investigations on the sub-

ject. An explanation is proposed for the influence of the ratio iron : silicon upon the earing of pure aluminum. (auth)

18173

THE ROLLING AND RECRYSTALLIZATION TEXTURE OF HAFNIUM. Herbert Müller (Universität, Vienna). Z. Metallk. 50, 346-50(1959) June. (In German)

The preferred orientation of cold-rolled hafnium (99.55%) was determined. In the stereographic (0001) diagram the most intense area forms an elliptic ring around the center of the pole figure, showing maximal intensity in the NR-QR direction in a distance of about 25° from the center (normal direction NR). The $[10\bar{1}0]$ direction is parallel to the rolling direction (WR). After recrystallization a mixed texture was found: the still existing rolling texture was superimposed by a (0001) $[11\bar{2}0]$ texture, rotated about 25° around the rolling direction. (auth)

18174

INVESTIGATION OF GALVANOMAGNETIC PHENOMENA IN CHROMIUM AT LOW TEMPERATURES. E. S. Borovik and V. G. Volotskaya (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1650-5(1959) June. (In Russian)

The Hall effect and variation of the resistance of chromium is studied in magnetic fields up to 27,000 Oe at temperatures from 4.2 to 78°K. The concentrations and mobilities of the electrons in chromium are calculated from the data obtained. A preliminary investigation of the properties of zirconium was carried out. (auth)

18175

MAGNETIC MOMENTS AND CURIE POINT OF Cu–Cd FERRITE SYSTEM. N. Z. Miryasov and L. G. Kolomin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1935-6(1959) June. (In Russian)

The temperature dependence of the saturation specific magnetization σ_S was investigated, and the magnetic moments of solid solution ferrite ($Cd_x\ Cu_{1-x}Fe_2\ O_4$) in which the concentration of Cd^{2+} was increased to 10% of the total divalent ions were determined. The specific magnetization was measured in the field range 6000 to 13000 gauss at six different temperatures between 278 to 293°K. (R.V.J.)

18176

CERAMICS AND GLASS. SELECTED GOVERNMENT RESEARCH REPORTS. VOLUME 10. London, Her Majesty's Stationery Office, 1952. 152p. $3.50.

The use of ceramic liners in gas turbine combustion chambers is discussed. An apparatus for the determination of the bend strength of ceramic materials at temperatures up to 1100°C is reported. A microscopic investigation is presented of the mechanical breakdown in sintered Al_2O_3. A method for obtaining the axial tensile loading of sintered Al_2O_3 test pieces is described, and results at room temperature are given. The mechanical properties of sintered Al_2O_3 are given. The variation of resistivity with temperature of sintered Al_2O_3 used for the insulators of sparking plugs is reported. The thermal stresses which may occur in practice on turbine blades and rocket nozzles made of brittle materials are considered. The improvement of ceramics for use in heat engines is discussed. Some experiments are reported on the hot pressing of ZrC powder at 2000°C. The effect of the surrounding atmosphere on the delayed fracture of glass was investigated. The fatigue in mineral glass under static and cyclic loading was investigated. The testing of glass optical flats, gelatine filters and register glasses for use in aircraft cameras is reported. (W.L.H.)

18177

PRUFUNG METALLISCHER WERKSTOFFE MIT GAMMASTRAHLEN. (Testing of Metallic Industrial Materials With Gamma Radiation.) S. V. Rumyantsev (S. W. Rumjanzew) and Ya. A. Grigorovich (J. A. Grigorowitsch). Translation of "Kontrol Kachestva Metallov Gamma-Luchami." Berlin, Veb Verlag Technik, 1957. 292p.

A textbook and handbook on the non-destructive testing of materials with gamma radiation is presented. The basic properties of natural and artificial radioactivity and the preparation and properties of radioisotopes are first considered. Processes in the passage of radiation through matter are surveyed. The irradiation of metals with gamma rays by the photomethod and radiography is discussed. Ionization methods for fault detection and metal thickness measurements are described in the last chapter. (J.S.R.)

18178

URANIUM PRODUCTION TECHNOLOGY. Charles D. Harrington and Archie E. Ruehle, eds. Princeton, N. J., D. Van Nostrand Company, Inc., 1959. 588p. $17.50.

This volume attempts to present the essential features of uranium production technology. Five chapters are general and deal with basic chemistry and metallurgy and with consideration of health and safety in protecting against new hazards. The other chapters discuss past, present, and possible future production methods, with emphasis on current practices. (W.L.H.)

18179

PRODUCTION OF URANIUM METAL. (to United Kingdom Atomic Energy Authority). British Patent 814,195. June 3, 1959.

A process is described which produces U metal by reduction of UCl_3 by alkali or alkaline earth metals. The reaction vessel consists of an 18/8 stainless steel crucible of $^1/_{16}$-in. wall thickness, 3-in. diam., and about 12-in. deep. This crucible is lined with powdered electrically fused 100-mesh MgO packed in with a tapered mandrel and a hand press. This liner leaves a volume $2^3/_8$-in. diam. at top and $1^7/_8$-in. diam. at the bottom. In one example 147 g of $^1/_4$-in. Na cubes are mixed with 750 g UCl_3 crystals and charged to the crucible which is sealed with a refractory lid and a stainless steel lid. This loaded crucible is placed in a 25/20 stainless steel tube in a resistance furnace. This tube is connected to a He system through a needle valve. After flushing with He, the temperature is raised to 1220°C during 3 hours and maintained there for $2^1/_2$ hours. About 90% of the U produced was in a well-fused regulus at the bottom of the crucible. Other examples of the process in which variations of charge composition and crucible liner were used are described giving reaction temperatures, yields, and times. (T.R.H.)

18180

IMPROVEMENTS IN OR RELATING TO THE BRAZING OF BERYLLIUM. Jack Williams and James William Samuel Jones (to United Kingdom Atomic Energy Authority). British Patent 814,270. June 3, 1959.

Beryllium pieces can be brazed easily using Mg to produce a stronger joint. The Mg is melted on the Be surfaces to be joined and heated to 750°C for 30 min to

allow Mg to diffuse into the Be. The Be–Mg alloy surfaces are then joined by interposing an Al layer and heating at 750°C in Ar for 10 min. The heating time is not so critical as in ordinary Al brazing since the alloy layer limits the Al diffusion. (T.R.H.)

18181

IMPROVEMENTS IN OR RELATING TO PRODUCTION OF URANIUM METAL MASSES. Albert Etheridge Williams (to United Kingdom Atomic Energy Authority). British Patent 814,521. June 10, 1959.

A procedure for extruding U at gamma temperatures is described. A die of fine-grained graphite having a high finish internally is used. U powder is introduced into a feed cylinder, heated to 980 to 1050°C, and extruded with 3000 to 4000 psi applied by a plunger as the assembly cools in an inert atmosphere. The internal bore of the die has a conical entry of ~120° angle. At 950°C and 4000 psi a bulk density of 18.8 g/cc is obtained. The extruded product has a smooth surface finish. (T.R.H.)

18182

IMPROVEMENTS IN OR RELATING TO THE REFINING OF METALS BY ZONE MELTING. Jean Robertson Murray (to United Kingdom Atomic Energy Authority). British Patent 815,074. June 17, 1959.

In zone refining of metals, the heating and cooling during one pass of the zone often cracks the crucible because of phase transitions. To prevent this, a procedure is suggested which involves keeping the whole mass of metal above the highest solid-phase transition temperature while the molten zone is passed. Thus in the zone-refining of U, the U and UO_2 crucible are kept above 776°C, the β–γ transition temperature, by a special furnace. The U stays in the γ phase while the molten zone passes through, avoiding the volume change on solidification. (T.R.H.)

18183

TERNARY URANIUM ALLOY. (to United Kingdom Atomic Energy Authority). British Patent 816,603. July 15, 1959.

An alloy containing 94 wt.% U, 5 wt.% Cr, and 1 wt.% Fe is described as suitably low melting (760°C) to be used in reactors with iron coolant tubes. (T.R.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

Refer also to abstract 18480.

18184 AECU-4062

Brookhaven National Lab., Upton, N. Y.

GAS SCATTERING LOSS IN THE ELECTRON ANALOG. E. D. Courant. Jan. 5, 1954. 6p. (EDC-7). $1.80(ph), $1.80(mf) OTS.

Modification of formulas for gas scattering losses in proton synchrotrons for use in a proposed electron analog are discussed. The electrons move with relativistic velocities, and the Born approximation is applicable. Numerical values are tabulated. (J.R.D.)

18185 AERE-A/R-2846

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

7 GeV PROTON SYNCHROTRON; OPTIMUM PHASING OF THE MAGNET POWER SUPPLY. P. F. Smith. Feb. 1959. 26p. $0.56(BIS).

Perturbations of the magnetic field in the 7-Bev proton synchrotron may result from power supply ripple voltages in a variety of ways. The likely magnitudes of the various perturbations are calculated, and the best choice of power supply circuit from this viewpoint is discussed. A particular 24-phase arrangement is shown to be advantageous. (auth)

18186 AERE-A/R-2849

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE 7 GeV PROTON SYNCHROTRON MAGNET — TRANSIENT PERTURBATIONS IN THE MAGNETIC FIELD. P. F. Smith. May 1959. 15p. $0.35(BIS).

Calculations were made of the probable magnitudes of magnetic field disturbances caused by transient oscillations in the energizing coil. Damping of these disturbances by eddy currents and parallel resistors is discussed. (auth)

18187 AERE-R-2860

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

7GeV PROTON SYNCHROTRON; SOME EFFECTS OF POWER SUPPLY RIPPLE VOLTAGE. J. J. Wilkins. Apr. 1959. 15p. $0.35(BIS).

The output voltage of the 7-Bev proton synchrotron power supply will contain 600 c/s and higher frequency ripple components. The effects of this ripple on synchrotron operation are discussed. It is shown that efficient ripple filtering devices will be required, particularly for satisfactory flat-top pulse operation. (auth)

18188 DESY-A1.5

Deutsches Electronen-Synchrotron, Hamburg.

ÜBER DIE GESTALTUNG DES DESY-MAGNETEN. (Configuration of DESY Magnets.) Werner Hardt. June 8, 1959. 38p.

The results of studies on the configuration of the magnets are reported. The pole contour is calculated for the D and F sectors. In the calculation the requirements of the pole contour, the geometrical significance of the calculation, the mathematical description of the image, analysis of the field ratios, value of given parameters, influence of symmetric deviation of the contour, and the influence of finite permeability, the coil, and wider yoke patterns are considered. The molding of the end blocks are discussed, and the magnetic circuit is considered. (J.S.R.)

18189 MURA-463

Midwestern Universities Research Assn., Madison.

CONCERNING THE $\nu/N \rightarrow \frac{1}{3}$ RESONANCE. IV. THE LIMITING-AMPLITUDE SOLUTION OF THE EQUATION $\frac{d^2 u}{d \phi^2} + (a + b \cos 2 \phi)\, u + \frac{B_1}{2} (\sin 2 \phi)\, u^2 = 0$. L. Jackson Laslett. June 3, 1959. 16p. Contract AT(11-1)-384. $0.50(OTS).

The equation shown in the title is reduced, by the transformations

$$v = \sqrt{\frac{N}{2\nu\beta}}\, u \text{ and } t = \frac{N}{2\nu} \int_0^{\phi} \frac{d\phi}{\beta}, \text{ to the form}$$

$$\frac{d^2 v}{dt^2} + \left(\frac{2\nu}{N}\right)^2 v + \frac{1}{2}\left[\sum_{m=1} b_m (\sin 2\, m\, t)\right] v^2 = 0.$$

Use is made of the results of an earlier report, in which the characteristics of the limiting-amplitude solution of this latter equation were obtained by a variational procedure and by application of the Moser method, to obtain corresponding information concerning the solution $u(\phi)$ of the first equation. The analytic work is carried through terms of order $(\frac{1}{3}-\nu/N)^2$ and applied to an example in which a = 0.1262875, ——→ b = 1.15, ν/N = 0.2997, and ——→ B_1 = 1. Comparisons with the results of direct digital computation for this example indicate the results of the analytic theory are within a few (2 to 4) % of computed values. (auth)

18190 MURA-477

Midwestern Universities Research Assn., Madison. COMPUTER STUDIES OF BEAM STACKING EFFECTS. David Reilly. June 30, 1959. 8p. Contract AT(11-1)-384. $1.80(ph), $1.80(mf) OTS.

The process of stacking beams at a certain energy causes an energy spread in beams already stacked at that energy or at other energies. A statistical study of this effect was made using a digital computer. RMS energy scattering and average displacements of the particles from their initial energies are given for $\Gamma = \sin \phi_s = 0.55$, for various initial energies near the turn off point of the r-f oscillator. (auth)

18191 MURA-480

Midwestern Universities Research Assn., Madison. LONGITUDINAL SPACE CHARGE EFFECTS—PHASE BOUNDARY EQUATIONS AND POTENTIAL KERNELS. C. E. Nielsen and A. M. Sessler. June 26, 1959. 19p. Contract AT(11-1)-384. $0.50(OTS).

An assembly of particles subject only to external fields and long-range interactions may be represented as an incompressible fluid in phase space; it follows that the behavior in the special case described by uniform phase density out to sharp boundaries is completely determined by the boundary motion. For azimuthal particle motion a derivation is given of two coupled non-linear first order partial differential equations describing the motion of the phase boundaries when they are single valued functions of coordinate and time. A derivation is also given of a potential function adequate for representation of the collective-field term in these equations even when charge density varies appreciably in a distance of the order of beam diameter. Computer programs are proposed for their solution. In the appendix certain implications of this potential kernel for the solutions in the small amplitude limit of MURA-441 are discussed. (auth)

18192 MURA-481

Midwestern Universities Research Assn., Madison. SETS OF EIGENVECTORS FOR VOLUMES OF REVOLUTION. J. Van Bladel. July 8, 1959. 38p. Contract AT(11-1)-384. $1.00(OTS).

The electric and magnetic eigenvectors of a volume of revolution can be written in terms of two-dimensional scalar and vector functions. These functions are the eigenfunctions of certain linear transformations in the meridian plane. The form of the transformations is examined, and much attention is devoted to the orthogonality properties of their eigenfunctions and the relation of their eigenvalues to variational principles. (auth)

18193 MURA-487

Midwestern Universities Research Assn., Madison, Wis. ACHIEVING HIGHER BEAM DENSITIES BY SUPERPOSING EQUILIBRIUM ORBITS. K. M. Terwilliger. July 8, 1959. 11p. Contract AT(11-1)-384. $0.50 (OTS).

Fixed field accelerators can produce a beam density high enough for colliding beam experiments only if a large number of injected pulses are spatially superimposed; this number is limited in present designs by the energy difference—hence equilibrium orbit separation—of successively "stacked" pulses. Without this separation the beam density could be increased while the beam dimensions and total beam current are made as small as desired. A simple method which achieves equilibrium orbit superposition is the addition of a perturbing field of the form $H_z = H'_M x \cos M\theta$, where x is the radial distance from a selected equilibrium orbit, and M is an integer close to ν_x. Until non-linear effects set in, the forced oscillations of other close-by equilibrium orbits are proportional to their momentum difference, so they all can be made tangent or crossing at the target region. A perturbing field which produces tangent equilibrium orbits for a simple machine geometry has been designed using the MURA IBM 704 computer. (auth)

18194 UCRL-8563

California. Univ., Berkeley. Lawrence Radiation Lab. BEVATRON OPERATION AND DEVELOPMENT. XVIII. [Period Covered] May, June, July 1958. Walter D. Hartsough. Apr. 1959. 26p. Contract W-7405-eng-48. $0.75(OTS).

An improvement in the injection system pulse-to-pulse performance and reliability was achieved by voltage regulation of the linear accelerator oscillator plate voltage and by temperature control of the beam-bunching cavity. The ion source was mechanically redesigned to permit unit arc-chamber replacement without disturbance to the extracting and focusing electrode alignment. The Bevatron was operated at reduced magnet voltage, using the east generator from June 1 to July 2 during the period of repair of the west generator. Normal two-generator operation resumed during the week of July 13. A substantial improvement in ignitron performance was recorded in this period. The particle physics program continued with investigations of $p-\bar{p}$ interactions and annihilations, $\Sigma^{\pm}$-hyperon decay, K^+-meson interactions, λ^0 decay, and strange-particle production in a π^- beam. Three target bombardments were made for the laboratory chemistry group, and nineteen bombardments for external groups. (For preceding period see UCRL-8334.) (auth)

18195

A CONTROL AND TELEMETERING SYSTEM, USING LIGHT BEAMS, FOR A VAN DE GRAAFF GENERATOR. Eskil Möller (Univ. of Lund, Sweden.). Arkiv Fysik 15, 89-96(1959).

A system, using light beams, for remote control and telemetering, was designed for the control of the equipment in the terminal of an electrostatic generator. Ten variables can be changed, one at a time. The desired function is chosen by a dial, and the position of the function (i.e., voltage) is read on an instrument on the control panel at the same time. The system is used with dual control. The telemetering system can be used for measurements of currents also in the microampere range. (auth)

18196

ELECTRON CAPTURE DURING THE ACCELERATION PHASE IN BETATRON AND SYNCHROTRON. P. A. Ryazin and A. B. Minervin. Atomnaya Energ. 6, 68-9 (1959) Jan. (In Russian)

A self-consistent solution was derived for problems considering the boundary and initial conditions in electron capture during the acceleration phase in betatrons and synchrotrons. A separate analysis is given of capture at the leading and trailing edge and at the plane portion of the pulse. (R.V.J.)

18197

START UP OF A CYCLOTRON WITH SPACE VARIATION OF THE MAGNETIC INTENSITY. D. P. Vasilevskaya, A. A. Glazov, V. I. Danilov, Yu. N. Denisov, V. P. Dzhelepov, V. P. Dmitrievskii, B. I. Zamolodchikov, N. L. Zaplatin, V. V. Kol'ga, A. A. Kropin, Liu-Nieh-Ch'uan, V. S. Rybalko, A. L. Savenkov, and L. A. Sarkisyan. Atomnaya Energ. 6, 657-8(1959) June. (In Russian)

Descriptions are given of the design and performance of a new type cyclic accelerator with a magnetic field of periodic structure along the azimuth and radius, which was put into operation Jan. 1959 by the Joint Inst. of Nuclear Research, Dubna. The diameter of the magnet is 1200 mm. The magnetic lines are bent along the spiral r (cm) = 16.2 φ; periodicity of the magnetic field is N = 6. It is indicated, theoretically, that the increase of the magnetic field along the radius, necessary for eliminating non-linear resonance effects at the center, can be reduced by increasing N (in non-linear resonance order) as $(N/2^N(N-1))$ and by the increase of the radial step in fixing N as $(\varkappa_1/\varkappa_2)^{N-2}$. A resonance single-dee quarterwave system was used for ion accelerations. The system was supplied by a generator with an independent excitation up to 40 kw. Deuterons with energies up to 12 Mev and α particles up to 24 Mev were accelerated. (R.V.J.)

18198

ON "COMBINED" ACCELERATORS. E. M. Moroz. Atomnaya Energ. 6, 660-1(1959) June. (In Russian)

The feasibility of using an annular accelerator for alternate or simultaneous acceleration of various particles was discussed previously by V. I. Veksler (Patent No. 111367, Apr. 29, 1957). It is shown that simultaneous proton and electron acceleration in the same accelerator is possible at quite high energies (up to several Bev). (R.V.J.)

18199

CONSTRUCTION OF A 14 Mev NEUTRON GENERATOR UTILIZING $T^3(d,n)He^4$ REACTION AND MEASUREMENT OF FAST NEUTRON FLUX. Bimalendu Mitra (Bose Inst., Calcutta). Indian J. Phys. 33, 149-57(1959) Apr.

Construction of a low-voltage accelerating machine for accelerating deuterons which is utilized as a source of production of 14-Mev neutrons by $T^3(d,n)He^4$ reaction is described. Neutron counting has been done by counting recoil protons in a suitable scintillation counter. Neutron yield has also been measured indirectly from saturated activity of an irradiated thin silver foil. Increase in relative flux with increasing deuteron energy from 30 kev to 0.1 Mev has been obtained. (auth)

18200

MAGNET FOR A SYNCHROTRON. Nuclear Energy Engr., 338-9(1959) July.

The 7,000-ton magnet core for the 7-Bev proton synchrotron, being constructed at Harwell, is fabricated in 336 separate sectors, at the rate of one a day. The core and precision necessary for the production of each of these sectors are described. (C.J.G.)

18201

ALDERMASTON'S TANDEM VAN DER GRAAF ACCELERATOR. Nuclear Energy Engr., 369-70; 377(1959) July.

A discussion of the new 12-Mev tandem Van de Graaff accelerator is presented. Beams of charged particles up to 12-Mev energy are obtainable. Negative ion source is situated outside the top of a pressurized tank, down the length of which runs the evacuated acceleration tube into which ions are introduced. An electrostatic generator runs up the lower half of the stack, thus allowing the half-way point to achieve voltages up to +6 Mv. Inside the vacuum tube at this point is a "stripper" consisting of a tube $^3/_{16}$ in. internal diameter and 24 in. long, into which gas is in continuous flow of 5 cm^3/hr. By hard pumping at either end of the tube, it is possible to preserve the vacuum in the main tube at between 5×10^{-5} mm and 5×10^{-6} mm while the pressure in the stripper is kept at an average of 0.02 mm. The beam emerging from the negative ion source is focused before entering the accelerating tube and the beam emerging from the stripper is further accelerated. Experiments are presently being carried out at energies up to 10.3 Mev. (C.J.G.)

18202

PRESENT STATE OF WORK ON THE ITALIAN 1200-Mev ELECTRON SYNCHROTRON AND ITS RESEARCH PROGRAM. M. Ageno, A. Alberigi, F. Amman, C. Bernardini, U. Bizzari, G. Bologna, G. Corazza, G. Cortellessa, G. Diambrini, G. Ghigo, A. Massarotti, G. C. Moneti, G. Murtas, E. Persico, M. Puglisi, I. F. Quercia, R. Querzoli, G. Sacerdoti, G. Salvini, G. Sanna, R. Toschi, and A. Turrin (Istituto Nazionale di Fisica Nucleare, Laboratori di Frascati, Italy). Nuovo cimento (10) 11, Suppl. No. 3, 324-44(1959). (In Italian)

The description of the present state of work on the Italian 1200-Mev electron synchrotron is given in three sections. In the first part, the positioning of the magnets and the vacuum plant and doughnut are reported. In the interior of the doughnut are placed the zinc sulfide detector for visualization of electron trajectories, the collector electrode, and the induction electrode. The use and operation of these three instruments are described in the second part. The experimental facilities of the synchrotron are briefly reviewed, and the special facilities needed for proposed studies are described. (J.S.R.)

18203

LONGITUDINAL MOTION OF ELECTRONS AND THE TOLERANCES IN A LINEAR ACCELERATOR. A. D. Vlasov. Radiotekh. i Elektron. 4, 295-302(1959).

The longitudinal electron motion and the tolerances in linear accelerators are analyzed with a consideration of an accelerator operating with traveling waves at a wavelength of 10 cm. The device is divided into sections and consists of a cylindrical disk-loaded waveguide. Expressions for the energy spectrum and injection conditions are derived. The reduction in the output energy because of the changes of the temperature, waveguide dimensions, and phase velocity of the accelerating wave is determined. Partial solutions of the equations are found. The application of the formulas is illustrated with a numerical example. (TCO-J.S.R.)

PHYSICS AND MATHEMATICS

General

18204 58-RL-2010

General Electric Co. Research Lab., Schenectady, N. Y.

APPLICABILITY OF THE LANGMUIR METALLIC

PROBE FOR STUDY OF THE ULTIMATE ELECTRONS OF THE NEGATIVE GLOW PLASMA. J. M. Anderson. Aug. 1958. 45p.

The conventional Langmuir metallic probe in the small cylindrical form is examined for its ability to accurately predict the electron density and electron temperature of the ultimate electrons in the negative glow plasma of a cold-cathode discharge in helium. The gas pressure is in the range ~1 to 10 mm Hg. Electron collection at space potential is found to most accurately indicate absolute electron density and the spatial profile of electron density. The basis for this statement is a comparison with simultaneous microwave propagation measurements at 9375 Mc/s. The influence of electron-ion momentum scattering above densities $\sim 10^{11}$ elec/cc on the accuracy of metallic probe measurements is demonstrated. For electron collection, it was noted that plasma space potential varied positively and falsified measurements of electron temperature. This effect was nullified by external electronic circuitry, and the resultant electron temperature measured was remarkably low, $\gtrsim$ 400°K. Positive ion collection to the negative probe could not be sensibly interpreted in this gas-pressure range, and indications were obtained that a considerable depression in charge density exists about the probe. The usefulness of this procedure in contrast to electron collection is doubtful. (auth)

18205 AAEC/E-28

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

CALCULATIONS OF THERMAL STRESSES IN HIFAR REACTOR SHELL STRUCTURE. D. R. Ebeling and N. D. Holt. May 1, 1958. 30p.

Calculations of thermal stresses in HIFAR reactor shell structure are presented. Thermal stresses will be induced in the circular crane beam by expansion of the reactor shell. Calculations assuming 100°F temperature difference show that thermal stresses of about 11,000 psi are probable and that the combined stresses due to expansion and crane loading are close to the maximum allowable. (auth)

18206 AECU-4247

Los Alamos Scientific Lab. N. Mex.

STATE PROPERTIES OF LIQUID AND SOLID XENON: A BIBLIOGRAPHY. Soliska R. Harris and Helen S. Stearns, comps. Oct. 17, 1957. 14p. Contract [W-7405-eng-36]. (D-BIB-14). $3.30(ph), $2.40(mf) OTS.

This bibliography consists of 59 references covering a period from 1926 to Sept. 1957. The sources consulted were Chemical Abstracts, Nuclear Science Abstracts, and Los Alamos Report Library Subject Catalog. The bibliography is arranged alphabetically by author. (J.E.D.)

18207 AERE-R-2916

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

HIGH FREQUENCY PROPERTIES OF A UNIFORM PLASMA. PART I. GENERAL FORMALISM AND ITS APPLICATION TO A FORCE FREE PLASMA. J. Randles. May 1959. 33p. $0.63(BIS).

A description of some of the main high-frequency phenomena in a spatially uniform plasma is set up, within a single mathematical framework. (auth)

18208 AFOSR-TN-59-588

Fairchild Engine and Airplane Corp. Fairchild Engine Div., Deer Park, N. Y.

SOME PROPERTIES OF A HYDROGEN PLASMA. Robert A. Gross and Charles L. Eisen. June 1959. 41p. Contract AF49(638)-15. (AD-216770).

The chemical equilibrium composition of a hydrogen mixture is determined over the temperature range from 10^3 to 10^6 °K and pressures from 10^{-6} to 10^6 atmospheres. The species recognized are, H_2, H, H^+, H^-, and e^-. Equilibrium and frozen values of γ, C_p and the speed of sound are presented in the dissociation and ionization regimes. Electrical conductivity and bremsstrahlung power radiation data are also given. (auth)

18209 AFOSR-TN-59-590

Fairchild Engine and Airplane Corp. Fairchild Engine Div., Deer Park, N. Y.

A DIRECT NUCLEAR ELECTROGENERATOR—ANALYSIS OF CYLINDRICAL ELECTRODE CONFIGURATION. Alfred Schock. June 15, 1959. 142p. Contract AF49(638)-15. (AD-216812).

A system for the direct conversion of nuclear fission energy to high voltage electricity is examined. The system is based on the motion of highly charged fission fragments counter to a strong electric field. In this manner, part of the fragments' kinetic energy is converted into potential (electric) energy. The superiority of cylindrical over plane electrodes is explained, and the effects of various geometric and operating variables on system performance are analyzed. It is possible to achieve conversion efficiencies up to 13%, electric power densities up to 4.5 megawatts per cubic meter of reactor core, and neutron multiplication factors up to 2.1. However, these three performance parameters are mutually interdependent, and the choice of a design point must represent a compromise between their respective maximization. The optimum design parameters will depend on the intended application of the system. (auth)

18210 AFOSR-TR-59-47

Madrid. Universidad.

STUDIES OF THERMAL MOTION IN CRYSTALS. Technical (Final) Report for December 15, 1956 to December 15, 1958. 82p. Project No. 9972. Contract AF61(514)-1146. (AD-215061).

A systematic survey of thermal continuous diffuse scattering was conducted in chain crystals, and a scheme of the dynamics of such molecular crystals was advanced. The atomic vibrations in such crystals were studied, and some relations between thermal expansion, polymorphism, and thermal diffuse scattering were examined in crystals such as oxalic acid dihydrate and α-succinic acid. The interpretation of x-ray thermal (continuous) diffuse scattering was accomplished in terms of the Difference Fourier Transform (DFT) of the molecules, and a full record of such thermal diffuse scattering was obtained for hexamine, naphthalene, and anthracene. DFT gives a good agreement with experimental data, showing that the main contribution to continuous diffuse scattering is that of the independent movement of the molecules in the crystal. Data presented are primarily from work of the last year which was not published. Only brief summary of the developments during the whole period is included. (auth)

18211 ANL-5997

Argonne National Lab., Lemont, Ill.

A METHOD FOR FINDING THE ZEROS OF REAL POLYNOMIALS: RESULTANT PROCEDURE. Erwin H. Bareiss. June 1959. 72p. Contract W-31-109-eng-38. $2.00(OTS).

The resultant procedure is a method for finding simultaneously all zeros of a polynomial with real

coefficients. There are no restrictions on the multiplicity of either the real or complex zeros. The principle of the resultant procedure is as follows. Assume that the absolute value ρ of a root α of the equation $P(x) = a_0 x^n + a_1 x^{n-1} + \ldots + a_n = 0$ is known. Then the resultant $R(p)$ of $P(x)$ and $Q(x) = x^2 + p x + \rho^2$ is computed by a simple recurrence relation. The real roots p_j of the equation $R(p) = 0$ that satisfy $-\rho \leq p_j/2 \leq \rho$ determine the real parts of the roots α of modulus ρ. The absolute values of α and p are obtained from the pivotal coefficients of a root-squaring algorithm. To be applicable to exceptional polynomials, e.g., polynomials containing cyclotomic factors, and to polynomials with roots of multiplicity up to n, the theory underlying the root squaring method had to be redeveloped, refined, and extended. In particular, criteria have been derived that enable the computer to make clear how to proceed. The resultant procedure has been coded for the IBM 704 and is in successful operation. The advantage of the code is that it furnishes all roots with predetermined accuracy in a predetermined number of steps. Although the complete theory of the resultant procedure is rather complicated, the resulting formulas are simple. It is believed that this is the first completely automatic code which is based on the root-squaring method. With small additions, the method can also be used to find the zeros of polynomials with complex coefficients. (auth)

18212 APEX-488

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

DIFFUSION TENSOR FOR SLAB GEOMETRY. J. R. Beeler. Dec. 1, 1958. 12p. Contracts AF33(600)-38062 and AT(11-1)-171. (XDC-59-1-254). $0.50 (OTS).

The magnitudes of the diagonal elements of the diffusion tensor for an infinite array of alternate solid slabs and void gaps are estimated by use of a Monte Carlo computation. The results indicate that diffusion along the slab normal (transverse direction) proceeds at the same rate as in the homogeneous counterpart of the heterogeneous system. Diffusion in a direction parallel to the slab planes (longitudinal direction), however, proceeds much faster than in the homogeneous system. For solid slabs and void gaps of equal width the anisotropy factor (ratio of the longitudinal to the transverse diffusion coefficient) is 2.2 when the ratio of the mean free path (in the solid slab) to the solid slab width is 0.25, and is 1.25 when this ratio is 2.0. (auth)

18213 APEX-493

General Electric Co. General Engineering Lab., Schenectady, N. Y.

THERMOCOUPLE TEMPERATURE RESPONSE STUDIES—HEAT TRANSFER BY RADIATION ONLY. S. S. Stack. Nov. 24, 1958. 27p. For General Electric Co. Aircraft Nuclear Propulsion Dept. Contract [AT(11-1)-171]. (XDC-59-3-229). $4.80(ph), $2.70 (mf) OTS.

Considerable interest has been shown in the "time response" or "time lag" of temperature sensors. This study is being made to experimentally measure the response rate of a thermocouple when subjected to a step change in surrounding wall temperature with heat transfer by radiation only and determine the validity of predicting from this measurement the response rate for other conditions of temperature, temperature differential and for either heating or cooling. (auth)

18214 BM-RI-5483

Bureau of Mines.

SPHERICAL PROPAGATION OF EXPLOSION-GENERATED STRAIN PULSES IN ROCK. Wilbur I. Duvall and Benjamin Petkof. July 1958. 24p.

Experimental data on the propagation of explosion-generated strain pulses in rock are presented. Tests were performed in 5 different rock types, employing 10 different types of explosives. Charge sizes ranged from 0.5 to 50 lb, and travel distances ranged from 2.5 to 70 ft. Analysis of the data shows that the experimental peak strain data satisfy an exponential decay propagation law of the form: $\epsilon R/W^{1/3} = Ke^{-\alpha R/W^{1/3}}$. For a particular rock, parameter K is a linear function of the calculated detonation pressure or the calculated energy density of the explosive. For a particular explosive, K is a linear function of the elastic parameter of the rock, ρc^2, a result, which is at variance with elastic theory. The absorption constant, α, is independent of type of explosive but dependent upon rock type. However, no definite relation between α and the physical properties of the rock could be established. (auth)

18215 BNL-550

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT FOR JANUARY 1–MARCH 31, 1959. June 1959. 50p. $1.50(OTS).

Progress in physics, chemistry, biology, medicine, and accelerator and reactor development is briefly summarized. (For preceding period see BNL-537.) (W.L.H.)

18216 BNL-3703

Brookhaven National Lab., Upton, N. Y.

THE USE OF SODIUM REACTOR COOLANT AS A SOURCE OF GAMMA RADIATION. B. Manowitz and D. M. Richman. Mar. 1958. 13p. $3.30(ph), $2.40 (mf) OTS.

The use of Na reactor coolant as a source of gamma radiation is discussed. Several reactors that use a sodium coolant are listed. Calculations were made to determine the specific activity and power availability of fast and thermal reactors that use sodium as a coolant. Detailed calculations show the dose rate available as a function of specific activity for one particular irradiator system. (W.L.H.)

18217 CERN-59-25

European Organization for Nuclear Research, Geneva.

CALCULATING HIGH ENERGY PARTICLE PRODUCTION ACCORDING TO STATISTICAL THEORIES ON AN ELECTRONIC COMPUTER. R. Hagedorn. July 2, 1959. 24p.

A program for an electronic computer is described which evaluates the results obtained by another program for phase space calculations. By multiplying the spectra of the different particles by appropriate weight factors and superposing them in a suitable way, one obtains automatically printed absolute probabilities for each single reaction, mean absolute numbers for each kind of particle, total energy spectra (CM system) for each kind of particle, and the spectra of decay particles emerging from two-particle decay of unstable products of the primary interactions including γ-spectra. (auth)

18218 CWR-900-12

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

VARI-1, A NONE-DIMENSIONAL VARIABLE GEOMETRY MULTIGROUP NUCLEAR DIFFUSION CODE.

J. M. Fontana, F. J. Casagrande, and W. J. Roberts. June 1, 1959. 99p.

VARI-1 continues the development of PROBE-II and GNU-II by providing for solution of 12 thermal groups, revised treatment of the fissionable source term, and option for zero flux at the extrapolated boundary, and inclusion of up to fifty isotopes per region. (W.D.M.)

18219 CWR-900-13-1

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

MONTE CARLO CALCULATIONS FOR NEUTRON AND GAMMA PARTICLE INTERACTIONS AND TRANSPORT IN ONE, TWO, AND THREE DIMENSIONAL NUCLEAR ASSEMBLIES—MAGNET I, PROGRAM FOR THREE DIMENSIONAL PLAQUE GEOMETRY. W. J. Roberts, Kevin L. Rooney, J. F. Logue, and J. A. DeVries. Apr. 1959. 129p.

MAGNET-I is designed to analyze heating, spectral shift, and leakage characteristics of compact gamma source cases. By compact it is meant systems of few mean free paths. The problem geometries allowed are spherical one dimensional, cylindrical two dimensional, and rectangular three dimensional. (W.D.M.)

18220 CWR-900-13-2

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

MONTE CARLO CALCULATIONS FOR NEUTRON AND GAMMA PARTICLE INTERACTIONS AND TRANSPORT IN ONE, TWO, AND THREE DIMENSIONAL NUCLEAR ASSEMBLIES—MAGNET II, PROGRAM FOR THREE DIMENSIONAL PLAQUE GEOMETRY (REVISED). J. F. Logue, W. J. Roberts, Kevin L. Rooney, and J. A. DeVries. [1959]. 116p.

18221 CWR-900-13-3

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

MONTE CARLO CALCULATIONS FOR NEUTRON AND GAMMA PARTICLE INTERACTIONS AND TRANSPORT IN ONE, TWO, AND THREE DIMENSIONAL NUCLEAR ASSEMBLIES—MAGNET III, PROGRAM FOR ONE AND TWO DIMENSIONAL GEOMETRY, GAMMA HEATING AND LEAKAGE. J. F. Logue, W. J. Roberts, Kevin L. Rooney, and J. A. DeVries. 236p.

The purpose of MAGNET III is to provide dose rate data or leakage data from systems of given cylindrical or spherical shapes. (W.D.M.)

18222 CWR-900-13-4

Curtiss-Wright Corp. Research Div., Quehanna, Penna.

MONTE CARLO CALCULATIONS FOR NEUTRON AND GAMMA PARTICLE INTERACTIONS AND TRANSPORT IN ONE, TWO, AND THREE DIMENSIONAL NUCLEAR ASSEMBLIES—MAGNET IV, PROGRAM FOR ONE AND TWO DIMENSIONAL GEOMETRY, NEUTRON INTERACTIONS, PLAIN SAMPLING. J. F. Logue, W. J. Roberts, Kevin L. Rooney, and J. A. DeVries. May 1959. 179p.

MAGNET IV is designed to attack two basic problems in fast reactor analysis. First, fast reactor criticality, neutron lifetime, isotopic absorption ratios, inelastic scattering by isotopes, leakage spectra, etc., in many region spherical and two dimensional cylindrical geometries. Second, for arbitrary source type, transmission through spherical and cylindrical annuli and absorption and energy loss in such annuli are determined. (W.D.M.)

18223 IDO-16525

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

A NUMERICAL METHOD FOR COMPUTING INVERSE LAPLACE TRANSFORMS. L. A. Schmittroth and R. L. Clayton. June 26, 1959. 18p. Contract AT(10-1)-205. $0.50(OTS).

A method is described for computing the inverse of a Laplace Transform F(s), when it is known that all singularities of F(s) lie in the left half-plane. The method was programmed for the IBM-650 and satisfactory results obtained. Some limitations and possible extensions are indicated. (W.D.M.)

18224 ISC-1115

Ames Lab., Ames, Iowa.

SEMI-ANNUAL SUMMARY RESEARCH REPORT IN PHYSICS FOR JULY–DECEMBER 1958. Apr. 15, 1959. 34p. Contract W-7405-eng-82. $1.00(OTS).

Experimental results on the magnetic properties of dysprosium were interpreted on the basis of a two-sublattice model. A new series expansion was obtained for the exterior potential of a homogeneous ellipsoid by finding first the Fourier transform of the potential. Preliminary measurements gave a threshold of 12.60 ± 0.10 Mev for the (γ,n) reaction on P^{31}. The gamma emission from Ag^{113} and Lu^{172} was studied. An experiment which will extend the search for isomeric states in deformed nuclei to states with half lives from 50×10^{-9} to 10^{-6} sec is described. Resonant beam extraction from an alternating gradient synchrotron is considered. Construction of the new intermediate-image spectrometer was completed, and its operating characteristics were determined. The electrical resistivity and thermal diffusivity of silver and tantalum were measured. Preliminary measurements on an n-type sample of Mg_2Si in the temperature range from 4 to 300°K indicate that the carrier concentration is about 3×10^{17} per cm^3 and that the impurity band conduction is predominant at temperatures below 25°K. Electrical properties of Cu_xWO_3 were investigated. The velocities of sound were measured in a sample of Mg_2Sn at room temperature. Heats of sublimation were determined for Gd, Ho, Lu, Eu, and Er. Electrical resistivity measurements were made on yttrium single crystals. The P-V-T diagram of Teflon was determined as a function of temperature from 77 to 350°K and as a function of pressure to 20,000 atmospheres. Superconductivity of tin crystals and beta-phase mercury was investigated. Nuclear magnetic resonances in Na_xWO_3 show essentially zero Knight shift ($-0.003 \pm 0.003\%$) for x-values of 0.56, 0.65, 0.73, 0.75, 0.78, 0.81, and 0.89. The activation volume of lithium was measured as 5.2 cm^3. (For preceding period see ISC-1048.) (W.D.M.)

18225 ITR-1703

Sandia Corp., Albuquerque, N. Mex. and California. Univ., Livermore. Lawrence Radiation Lab.

SURFACE AND SUBSURFACE STRONG MOTION MEASUREMENTS. William R. Perret. Aug. 10, 1959. 63p. Projects 26.2 and 26.10 [of] OPERATION HARDTACK. $1.75(OTS).

Strong motion measurements were made within rock on a vertical radius directly above Evans shot at ranges from 235 feet to the surface at 850 feet and on the mesa surface at ranges out to 12,000 feet from the surface zeros of Tamalpais, Evans, and Blanca shots of Operation Hardtack, Phase II. The complementary surface motion project observed motion of an array of targets in

the vicinity of Evans and Blanca surface zeros by means of calibrated motion photography. Vertical radius instrumentation was primarily accelerometers, but stress, strain, and temperature gages were included. Surface motion measurements comprised only vertical and horizontal radial accelerations. Signals from all gages of the vertical array were very weak, and precision suffered accordingly because Evans yielded only about 1 percent of anticipated energy. Acceleration data from the vertical array follow the trends of variation with radial range similar to those indicated by Rainier data: peak accelerations vary inversely with fourth power of range up to the base of the caprock, where the trend inverts and peaks increase toward the surface. Stress, strain, and temperature gages yielded no relevant information. Surface accelerations include a few data which represent signals of only a few percent of gage range and are consequently of low precision. Peak accelerations decrease with increased range, but scatter does not permit a clear distinction between suggested R^{-2} and R^{-3} variation. Photography showed that the ground surface above Evans did not move more than 2 inches, the limit of resolution of the camera system. Movement of targets near Blanca surface zero was defined for a period of greater than 8 seconds after detonation. (auth)

18226 ITR-1705
Coast and Geodetic Survey, Washington, D. C.
SURFACE MOTIONS FROM A SERIES OF UNDERGROUND NUCLEAR TESTS. D. S. Carder, W. K. Cloud, T. H. Pearce, and L. M. Murphy. Jan. 1959. 74p. Project 26.4 [of] OPERATION HARDTACK. $2.25(OTS).

Ground effects resulting from Blanca, Logan, Evans, Tamalpais, and Mars events of HARDTACK Phase II underground explosions were measured by strong-motion and teleseismic seismographs out to distances of nearly 100 miles. In addition, many temporary seismographs were operated by a number of organizations to distances of nearly 2400 miles, and routine seismographs continued to operate on a world-wide basis. Some of the results are given in this report. For safety purposes, predictions of ground effects, using formulas derived by the U. S. Coast and Geodetic Survey from pre-Rainier HE tests and modified slightly as a result of the Rainier tests, hold true with reasonable accuracy. (auth)

18227 ITR-1709
Ballistic Research Labs., Aberdeen Proving Ground, Md.
PRELIMINARY REPORT ON MEDIUM STUDIES. B. Perkins, Jr. and A. A. Thompson. Dec. 1958. 27p. Project 26.8 [of] OPERATION HARDTACK, PHASE II. $1.00(OTS).

On Operation Hardtack, thirty instruments were installed for the Tamalpais Shot to measure the ground shock parameters of the seismic wave resulting from a contained nuclear explosion in tuff material of a weapon having a total energy yield equivalent to 0.057 kt of TNT. About half the records were lost due to an oscillator power supply failure, caused by the malfunctioning of the battery charger following the final dry run. The following measurements were recorded at Tamalpais and are reproduced: Five stress time histories were measured from 100 to 410 feet from the explosion. Two displacement time histories were recorded at 300 feet from the detonation. Four displacement time histories were recorded at distances greater than 10,000 feet from the explosion. On the Evans Shot, ten instruments were installed to measure the (free field) ground shock parameters of the seismic wave resulting from a contained nuclear explosion in tuff material with a predicted yield equivalent to 8 kt of TNT. The energy yield resulting in the Evans Shot was so much less than the expected yield that the amplitude of all records were too small to be of value. (auth)

18228 KAPL-M-WBL-2
Knolls Atomic Power Lab., Schenectady, N. Y.
USE OF THE IBM 704 IN REDUCTION OF FOIL COUNTING DATA. W. B. Leng. May 15, 1959. 57p. Contract W-31-109-Eng-52. $9.30(ph), $3.60(mf) OTS.

The IBM-650 was replaced by an IBM-704. This change required reprogramming all codes used in foil counting data reduction. The reprogramming of these codes is described. (W.L.H.)

18229 LAMS-1961
Los Alamos Scientific Lab., N. Mex.
AN OPTICAL FALLOUT ANALOGUE. Gaelen L. Felt. Oct. 1955. 77p. Contract W-7405-eng-36. $12.30(ph), $4.50(mf) OTS.

The principle of the optical analog is that a plate may be exposed in such a way that the resulting photographic density distribution represents the surface density of fall-out debris from a nuclear detonation. The essential components are an optical filtering system which controls the intensity of light according to the assumed initial distribution of activity over height and particle size and according to the assumed decay rate, a size control system which depends on the lateral dimensions of the cloud of debris and adjusts the size of the light beam accordingly, and a position control system which moves the beam to the correct position on the plate as determined by the wind structure and the time of fall of the particles. The machine described is intended as a fall-out forecasting instrument for use in test operations. The development of the basic design equations and design criteria follows from the intended application. The treatment is, however, general enough to be of use to persons interested in variants of the analog designed for other applications. (auth)

18230 NAA-SR-Memo-4033
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RECENT EXPERIENCES WITH CANDLE I. R. A. Blaine. June 18, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

Methods for the use of the Candle I 704 code are presented. (W.L.H.)

18231 NEVIS-59
Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.
USE OF AN IBM 650 TO CALCULATE CLOUD CHAMBER EVENTS. R. Bingham, D. Tycko, and L. McDermott. Nov. 1957. 27p. Contracts N6-ori-110, Task No. 1 and AT(30-1)-1932. (CU-154-57-ONR-110-Phys.). $4.80(ph), $2.70(mf) OTS.

In this method a fixed coördinate system is set up in the cloud chamber. The projected coördinates in two views of the vertex and one other point (droplet) are measured for each track, and a template is used to get the average radius of curvature of the reprojected track in each view. The IBM-650 calculates the momenta of all curved tracks, the kinetic energy (with assumed masses), the direction cosines of all tracks, and the

space angle between the incoming track and each of the outgoing tracks as these angles appear in the reprojected view. (W.L.H.)

18232 NP-7714

Fulmer Research Inst., Ltd., Stoke Poges, Bucks, England.

THE CRYSTAL STRUCTURE OF URe_2. B. A. Hatt. [Sept. 1955]. 26p. (R.53/19/Sept. '55).

A compound URe_2 has been shown to exist in the uranium–rhenium binary system and its structure determined. Above 180°C this is a C14 Laves structure; below this temperature the symmetry reduces to orthorhombic. (auth)

18233 NP-7748

Illinois. Univ., Urbana. Noyes Lab. of Chemistry.

ISOTOPE EFFECTS IN HIGH RESOLUTION NMR SPECTROSCOPY. Technical Report No. 18. H. S. Gutowsky. May 6, 1959. 6p. Contract Nonr-1834 (13).

Quantitative explanation of the proton isotopic shifts will require detailed calculations including the effects of the vibrations upon the C-H bond character. (C.J.G.)

18234 NP-7784

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

IRON SERIES HARTREE-FOCK CALCULATIONS. Technical Report No. 12. Richard E. Watson. June 15, 1959. 264p. Contract Nonr-1841(34).

The results of 76 analytic Hartree-Fock calculations for iron series atoms and ions are presented. The elements included are Sc, Ti, U, Cr, Mn, Fe, Co, Ni, and Cu. H-F equations for the single, multi-determinant, and average of a configuration cases are discussed. Methods are described for solving the H-F equations with emphasis on the Roothaan procedure. Basic functions necessary for Roothaan procedure calculations are considered. A discussion of the results is given. (W.D.M.)

18235 NYO-8053

Princeton Univ., N. J. Project Matterhorn.

OSCILLATIONS OF A FINITE COLD PLASMA IN A STRONG MAGNETIC FIELD. John Dawson and Carl Oberman. Oct. 30, 1958. 41p. Contract AT(30-1)-1238. (PM-S-39). $1.25(OTS).

Of prime concern in plasma investigations is the coupling of a bounded plasma with external electromagnetic fields. The properties of the normal modes of a cold plasma slab, and cylinder, situated in a strong magnetic field are derived, and then used to discuss the transmission and reflection of radiation, the scattering by a plasma cylinder, the response to driving sources in the vicinity of the plasma, and the radiation due to plasma oscillations. (auth)

18236 ORNL-2350

Oak Ridge National Lab., Tenn.

THE LID TANK SHIELDING FACILITY AT OAK RIDGE NATIONAL LABORATORY. PART II. DETERMINATION OF THE FISSION RATE OF THE SOURCE PLATE. D. R. Otis. Aug. 8, 1959. 5p. Contract W-7405-eng-26. $1.50(OTS).

Following the installation of the second Lid Tank Shielding Facility source plate, a thin uranium disk identified as SP-2, a series of experiments were performed to determine its fission rate. Three independent methods were used, one based on the rate of absorption of the thermal neutrons incident on the plate, another based on the rate of fast-neutron production within the plate, and a third one based on the power dissipation within the plate. Discussions of the methods, all of which yielded consistent results, are presented, along with a description of the source plate. A weighed average of the fission rates determined by the three methods gave a result of 1.66×10^{11} fissions/sec ± 5% for the standard incident thermal-neutron flux. With an assumed energy dissipation of 200 Mev/fission, a typical reactor having this fission rate would release 5.22 watts of heat power. The calibration of the SP-2 allowed a re-evaluation of the power of the first LTSF source plate, the SP-1. The revised "effective" neutron power for SP-1 is 1.7 watts ± 11%. (auth)

18237 ORNL-2729

Oak Ridge National Lab., Tenn.

A MONTE CARLO CALCULATION OF HIGH-ENERGY SPUTTERING. D. T. Goldman, D. E. Harrison, and R. R. Coveyou. Aug. 12, 1959. 16p. Contract W-7405-eng-26. $0.75(OTS).

A machine calculation using an IBM-704 High-Speed Calculator was used to determine the sputtering produced by high-energy (~ 100-kev) deuterons incident on copper metal. The initial displacement interaction between incident and lattice particles was taken to be Coulomb, and subsequent lattice ion–lattice ion interaction potential to be hard sphere. The value of the sputtering ratio in this energy range was found to be in agreement with that predicted by a theory of Goldman and Simon. Various suggestions are given to improve the machine calculations and to include a screened Coulomb initial interaction which would enable the code to be used for lower energy incident particles. (auth)

18238 RAS-13(Rev. 1)

General Dynamics Corp. Electric Boat Div., Groton, Conn.

THE CONVERSION OF FAST NEUTRON FLUX TO DOSE FOR POLONIUM–BERYLLIUM AND PLUTONIUM–BERYLLIUM NEUTRON SOURCES. E. L. Czapek. Nov. 17, 1958. 8p.

Dose conversion data for the fast neutron flux from Be–Po and Be–Pu neutron sources are presented. (J.R.D.)

18239 SCR-92

Sandia Corp., Albuquerque, N. Mex.

THE ELECTRICAL BEHAVIOR OF FINE WIRES EXPLODED BY A COAXIAL CABLE DISCHARGE SYSTEM. T. J. Tucker and F. W. Neilson. May 1959. 15p. $0.50(OTS).

Presented at Conference on Exploding Wires, Boston, Mass., April 1959.

The characteristic square output current pulse from a discharging coaxial cable has been utilized to explode wires of 1-mil diameter. The primary pulse duration was 3 μsec and was variable in amplitude to a maximum of 600 amperes. Voltage and current waveforms were recorded on a high-speed oscilloscope. Resolution of the system is better than 10^{-8} sec, thus enabling accurate determination of the resistance history of the material being studied. A survey of the behavior of various metals is presented, and the results of certain parameter studies, such as, geometry, external environment, and current density, are discussed. It is shown that end effects contribute to the measured length of the sample, and that the energy to burst is dependent on current density. A new experimental system capable of producing square current pulses with an amplitude of 2000 amperes is described. (auth)

18240 SCR-94
Sandia Corp., Albuquerque, N. Mex.
USE OF THE "ACTION INTEGRAL" IN EW STUDIES. G. W. Anderson and F. W. Neilson. May 1959. 10p. $0.50(OTS).

Presented at Conference on Exploding Wires, Boston, Mass., April 1959.

The "action integral" is defined by $I(t) = \int i^2 dt$, where i is the current in the exploding wire and t is the time. (The name derives from an inexact analogy with classical mechanics: $i:\dot{x}$, $dq(= idt):dx$, and $I:\int \dot{x}dx$.) For many purposes, I is a useful supplement to the energy integral, $U = \int i^2 r dt$, where r is the resistance of the wire. For example, it is expected that at voltage spike time $I_s = kA^2$ and $U_s = k'lA$, where k and k' are constants of the wire material, and l and A are, respectively, the length and cross-sectional area of the wire. The relation for I_s was found experimentally to hold within 10 percent over ranges of 2000:1 in A, 400:1 in l, and 10:1 in current density. In contrast, the U_s relation failed to hold for changes in l and in current density. For many purposes, the nonlinear behavior of r is expressed more conveniently by $r = r(I)$ than by $r = r(U)$, although neither was found adequate over large ranges of average current density. Machine calculations making use of some of these properties have been completed and are presented. (auth)

18241 SCTM-72-56(51)
Sandia Corp., Albuquerque, N. Mex.
PROGRESS IN THE IMPACT MITIGATION OF AN INSTRUMENTED VEHICLE. A. Goodman and D. C. Williams. June 4, 1956. 43p. Contract [AT(29-1)-789]. $7.80(ph), $3.30(mf) OTS.

A résumé of the experimental results, which are applicable to the impact mitigation problem, is presented. The general requirements of a cushion and typical results of the materials tested thus far are discussed. Charts are included of the size and weight of a simplified cushion made of aluminum honeycomb for various design conditions. Though the research program is not sufficiently advanced to determine an optimum cushion design, present experimental evidence indicates that an adequate cushioning device can be developed. (auth)

18242 SCTM-174-59(14)
Sandia Corp., Albuquerque, N. Mex.
THE COMBINATION MODE EET. J. M. Canfield. June 11, 1959. 12p. $0.50(OTS).

The action of an explosive-electric transducer (EET) shocked in a combination axial-normal mode is derived from the Neilson EET theory. Theoretical and experimental voltage outputs are compared. (auth)

18243 SCTM-195-58(51)
Sandia Corp., Albuquerque, N. Mex.
CURVES FOR ESTIMATING LOW BLAST OVERPRESSURE. L. J. Vortman. Apr. 1958. 4p. Contract [AT(29-1)-789]. $0.50(OTS).

A plot of overpressure versus distance is presented for the fractional psi pressure level. The plot provides a rapid and simple means of estimating the permissible yield at any distance from settled areas. (auth)

18244 SCTM-224-59(12)
Sandia Corp., Albuquerque, N. Mex.
VOLUME, WEIGHT, CENTER OF GRAVITY, AND MOMENTS OF INERTIA OF A SOLID CONE FRUSTUM. G. W. Hughes. July 14, 1959. 8p. Contract [AT(29-1)-789]. $1.80(ph), $1.80(mf) OTS.

Equations and graphs are presented which may be used to calculate volume, weight, center of gravity, and moments of inertia of a solid cone frustum. (auth)

18245 SCTM-239-55(51)
Sandia Corp., Albuquerque, N. Mex.
ONE-DIMENSIONAL COMPRESSIBLE FLOWS OF MAGNETO-HYDRODYNAMICS. II. O. G. Owens. Nov. 7, 1955. 13p. $3.30(ph), $2.40(mf) OTS.

In a previous paper a one-dimensional problem of magneto-hydrodynamics was treated, assuming that the electrically conducting medium was compressible and had infinite conductivity. The enclosed results concern an analogous problem, but now the compressible conducting medium is assumed to have finite conductivity. For finite conductivity the equations of magneto-hydrodynamics are more complicated than those governing the infinite conductivity case. Nevertheless, a plane-wave solution of the problem is obtained; this solution gives all the physical quantities in explicit analytical form, provided that the solution of a fundamental first order ordinary differential equation is available, either analytically or numerically. (auth)

18246 SCTM-384-58-51
Sandia Corp., Albuquerque, N. Mex.
THE PRICE OF CONTAINING RADIOACTIVITY IN DIGGING CRATERS. Byron F. Murphey. Oct. 1958. Decl. Apr. 27, 1959. 6p. Contract [AT(29-1)-789]. $1.80(ph), $1.80(mf) OTS.

The possibility is considered that useful craters may be obtained by means of shallow underground explosions of thermonuclear devices. The price of containing radioactivity in such craters is considered for underground and surface bursts. Data obtained from Rainier Burst during Operation Plumbbob and from Operation Teapot are used as a basis for the calculations. (C.H.)

18247 UCRL-5478
California. Univ., Livermore. Lawrence Radiation Lab.
STUDY OF ELECTRIC PROPULSION SYSTEMS FOR SPACE TRAVEL. Interim Progress Report for July 1 to December 31, 1958. Robert H. Fox. Feb. 6, 1959. 91p. Contract W-7405-eng-48. $15.30(ph), $5.40(mf) OTS.

The object of the one-year study is to assess the feasibility of obtaining a value of 0.10 kw/kg for specific power in a space environment and to recommend those avenues of research and development which appear most promising. In order to lay a proper foundation for an ion propulsion study it is necessary to determine the relationship among mission requirements, propulsion-system specific power, and payload fraction. Some theoretical studies of a simple nature supplemented by some powered trajectory calculations on the IBM-704 were carried out. For a conventional power conversion system, an analysis of the Brayton cycle was carried out and compared to the Rankine cycle. Preliminary estimates have indicated that reactor weight need not be a major factor unless the total power output is small and shielding is required for humans. A preliminary study of the direct conversion of heat into electricity as applied to space flight is presented. Thermoelectric and thermionic methods are examined. The thermoelectric and high vacuum thermionic systems appear to have severe problems in their application to space propulsion. The space charge neutralized thermionic converter shows considerably greater promise. Various methods are proposed for obtaining high efficiencies and long-term reliability. Using this form of converter for space

flight, a ratio of 1 kg/kw of weight of power source plus radiator to power output seems feasible. When a low sink temperature is available 50% efficiencies or greater appear attainable. Solar energy was studied and the basic facts which make the use of it unattractive for propulsion applications are the low value of the solar constant in the vicinity of the Earths' orbit and its decrease with the square of the distance from the Sun. The basic concepts of thrust production by means of electrostatically accelerated ion beams are theoretically sound. Certain fundamental parameters are reviewed to determine whether it is practical on the basis of present knowledge to utilize the electrostatic thrust chamber to propel space vehicles. Very preliminary consideration was given to three advanced concepts for propulsion: magnetohydrodynamic generator-gaseous reactor; free piston reactor; and exploding wire thrust chamber. One possible application of low-thrust propulsive devices with high specific impulse is the perturbation of satellite orbits. The relationship among perturbation rate, payload fraction, propulsion plant specific power, and propulsion plant lifetime is shown. (W.D.M.)

18248 UCRL-8762
California. Univ., Berkeley. Lawrence Radiation Lab.
RANGE-ENERGY MEASUREMENTS FOR 742-Mev PROTONS (thesis). John E. Ward. May 4, 1959. 39p. Contract W-7405-eng-48. $1.25(OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

A proposal is presented for an experiment to measure the relative stopping powers of Be, Al, Fe, Cu, Ag, W, Pb, and U by magnetically analyzing the degraded proton energies of the 742-Mev proton beam of the Berkeley cyclotron after passage through the absorbing elements. (auth)

18249 WADC-TR-59-194
Borg-Warner Corp. Research Center, Des Plaines, Ill.
PULSED PLASMA PROPULSION — AN ADVANCED REACTION SPACE PROPULSION SYSTEM. Summary of Literature Survey. Thomas L. Thourson. Apr. 1959. 132p. Project No. R-3148. Contract AF33(616)-6036.

A literature survey on pulsed plasma propulsion, an advanced space propulsion system, is presented. Included is a discussion of experimental and analytical investigations of various pulsed plasma propulsion schemes. Other topics included are: competitive propulsion systems, studies in plasma physics, studies in electric breakdown phenomena, and experimental and diagnostic techniques applicable to the study of plasma physics. (auth)

18250 WAPD-TH-381
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EXPERIMENTAL MEASUREMENTS OF MIXING IN PARALLEL FLOW ROD BUNDLES. W. H. Bell and B. W. LeTourneau. Feb. 18, 1958. 17p. $3.30(ph), $2.40(mf) OTS.

The results of the experimental phase of the problem of determining the mixing that occurs between coolant systems in parallel-flow rod-type subassemblies are discussed. (J.E.D.)

18251 WAPD-TH-385
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PRELIMINARY VERTICAL UPFLOW BOILING PRESSURE DROP DATA FOR WATER IN A 0.070 IN. × 2.25 IN. × 72 IN. LONG RECTANGULAR CHANNEL AT 2000 PSIA. R. A. DeBortoli and M. Troy. [Dec. 1957]. 15p. $3.30(ph), $2.40(mf) OTS.

The tests were made to determine the effect of greater channel length on boiling and non-boiling pressure drop. (W.L.H.)

18252 WAPD-TM-130
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
CRITICAL EXPERIMENTS WITH A SEED AND BLANKET SLAB GEOMETRY ASSEMBLY. S. H. Levine, E. J. Hanraty, P. G. Johnson, L. A. Mikoleit, S. L. Shufler, and W. F. G. Vogelsang. July 1959. 95p. Contract AT-11-1-GEN-14. $2.25(OTS).

A series of critical experiments was performed on slab geometry critical assemblies to study the basic behavior of seed-blanket type cores. These experiments included water-worth measurements, inference of excess and shutdown reactivities, temperature coefficients, three-dimensional activations, control rod worths, and the effect of burnable poison (boron). In most cases, theoretical calculations are compared to the experimental results, and the agreement between experiment and theory, in general, is quite good. (auth)

18253 WAPD-TM-165
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
AN APPLICATION OF SPENCER'S METHOD TO THE STIELTJES AND HAMBURGER MOMENT PROBLEMS. W. H. Guilinger. July 1959. 15p. Contract AT-11-1-GEN-14. $0.75(OTS).

Given the moments of a function, it is often desirable to obtain a numerical approximation of the function. A method for estimating the solutions of the Stieltjes and Hamburger moment problems is developed. Calculations indicate that the method is both feasible and accurate. (auth)

18254 AEC-tr-3602
APPLIED MAGNETO-HYDRODYNAMICS. (Prikladnya Magnitogidrodinamika.) Translated by Benjamin Skolnikoff from Trudy Inst. Fiz., Akad. Nauk Latv. S.S.R. 8, 1956. 127p. $2.75(OTS).

Nine papers from the Transactions of the Institute of Physics of the Academy of Sciences, Latvian SSR, are presented. Topics covered include modeling of magnetohydrodynamic phenomena in liquid metals, theory of induction pumps, velocity distribution and magnetohydraulic pressure losses in a rectangular duct, electromagnetic phenomena in induction pumps, edge effects in linear induction pumps, design of induction pumps for liquid metal, single-phase pumps, and the problem of a conducting sphere in a traveling magnetic field. (W.D.M.)

18255 AEC-tr-3715
MOLECULAR FLOW AND EFFUSION OF GASES THROUGH ORIFICES. (Die Molekularströmung der Gase durch Öffnungen und die Effusion.) Martin Knudsen. Translated by K. D. Carlson and E. D. Cater (Argonne National Lab.) from Ann. Physik (4), 28, 999-1016(1909). 23p. $4.80(ph), $2.70(mf) JCL.

It is shown that whenever a gas flows through a tube whose cross-sectional dimension is small in comparison with the mean free path of the gas molecules, the amount of gas flowing per unit time is dependent only upon the dimensions of the tube, the square root of the specific gravity of the gas, and the difference in pressure. (W.L.H.)

18256 AEC-tr-3730
EQUILIBRIUMS IN SYSTEMS, CONTAINING LAMINARLY DISTRIBUTED PHASES IN CONNECTION WITH

THE QUESTION OF SPONTANEOUS SURFACE INCREASE OF MICROSCOPIC STRUCTURES. (Über Gleichgewichte in Systemen, welche flächenhaft verteilte Phasen enthalten, im Zusammenhang mit der Frage nach der spontanen Oberflächenvergrösserung von mikroskopischen Gebilden.) N. v[on] Raschevsky. Translated for Oak Ridge National Lab. from Z. Physik 51, 571-83(1928). 34p. (Includes original, 12p.). $6.30(ph), $3.00(mf) JCL.

The monomolecular layers which occasionally form at the surface of solutions are treated as independent phases. The equilibrium is investigated in a closed system consisting of a spatially expanded phase and a two-dimensional plane phase with the assumption that the two phases are in a chemical interaction. The result is found that generally with a given volume of the system the total free energy F depends on the surface area of the surface, so that a certain surface area exists under certain circumstances which corresponds to the minimum of F, i.e., to the stable equilibrium. For this value of surface area the capillary pressure disappears, and therefore a free liquid system also can assume a non-spherical structure. Changes of the system are investigated which occur with gradual changes of the total masses of the components contained in the system. It is shown that on occasion spontaneous increases of the surface can occur as a consequence of the above-mentioned results, which increases are expressed either in an expansion or in a separation of the system. (auth)

18257 CEA-tr-R-687

DÉTERMINATION DE LA COMPOSITION ISOTOPIQUE D'APRÈS LES SPECTRES D'ADSORPTION. (Determination of the Isotopic Composition from the Absorption Spectra.) A. N. Zaidel. Translated into French from Optika i Spektroskopiya 4, 701-2(1958). 4p.

The determination of the isotopic concentration by the use of flame absorption spectroscopy is suggested. An expression is derived to give the ratio of the isotopic concentrations. Experimental results will be reported later. (J.S.R.)

18258 NP-tr-259

INVESTIGATIONS INTO THE LATTICE DISORDERS OF THE FLUORITE LATTICE AND THE CUBIC LATTICE 'C' OF THE RARE EARTH OXIDES. M[aria] Bruno and A[ldo] Mayer. Translated by S. Fitzgerald (U.K.A.E.A., Atomic Energy Research Establishment) from Ricerca sci. 28, 1168-73(1958). 9p. $1.80(ph), $1.80(mf) OTS.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16291.

18259 NP-tr-272

ANNOTATED BIBLIOGRAPHY ON ELECTRIC DISCHARGES IN GASES AND ON PLASMA. Elias Bacha. Translated from Soviet open sources, 1950–1959. 71p.

A bibliography of Soviet publications on electric discharges for the years 1950 to 1958 is presented. The bibliography is divided into two sections, one dealing with gas discharge and the other with plasma. The listed publications contain information on basic principles, theory, and applications. (J.R.D.)

18260 SCL-T-256

MEASUREMENT OF THE OSCILLATOR INTENSITY OF SOME O I LINES IN A WATER-STABILIZED LIGHT ARC. (Messung der Oszillatorenstarke einiger O I-Linien in Wasserstabilisierten Lichtbogen.) Günter Jürgens. Translated by Marcel L. Weinreich (Sandia Corp.) from Z. Physik 138, 613-22(1954). 15p. $3.30(ph), $2.40(mf) JCL.

The oscillator intensities of the more intensive oxygen lines between 3900 and 8300 A are determined absolutely by means of an intensity comparison. The experimental results agree in most cases with the theoretical value of Bates and Damgard, fluctuating within a margin of ± 25%. (auth)

18261 T-101(RAND)

RADIATION OF PLASMA IN A MAGNETIC FIELD. B. A. Trubnikov. Translated by R. D. Burke from Doklady Akad. Nauk S.S.S.R. 118, 913-16(1958). 12p.

The radiation of plasma and the associated spiraling of electrons in a uniform magnetic field are examined. Formulas are given for the radiation rate of a unit volume of plasma, degree of polarization, and the coefficient of absorption. (C.J.G.)

18262 TIL/T-4575

MATERIAL TESTING BY MEANS OF BETATRON X-RAYS. (Werkstoffpruefung Mit Betatron-Roentgenstrahlen.) R. Widerŏe. Translated from Z. Ver. deut. Ingr. 96, 450-6(1954). 16p. (AD-204528). $4.80(ph), $2.70(mf) JCL.

Materials testing by means of betatron x rays is discussed. Properties of these x rays are described, and their use in examining large wall thicknesses of iron is considered. (J.R.D.)

18263

SYMPOSIUM ON ELEVATED TEMPERATURE STRAIN GAGES. ASTM Special Technical Publication No. 230. Philadelphia, American Society for Testing Materials, 1958. 166p. $4.50.

The papers presented at the symposium describe the latest work in the design and application of strain gages at high temperatures. The subjects covered in the 24 papers included: calibration techniques and instruments, gage alloys, foil gages, weldable gages, bonding agents, and temperature compensation. (W.L.H.)

18264

MODIFIED BOHM AND PINES COLLECTIVE DESCRIPTION OF ELECTRON INTERACTIONS IN CRYSTALS. II. Jan. Śledzik (Polish Academy of Science, [Warsaw]). Acta Phys. Polon. 18, 57-73(1959).

The canonical transformation which excludes from the hamiltonian the interaction term H_{inter} is analyzed. It is proved that the transformation, applied in approximation of first commutators with generating function of transformation, leads to changed subsidiary conditions and a new hamiltonian expressed in the Bohm-Pines representation. It is pointed out that because of the approximation degree used in applying the transformation the set of supplementary conditions and the new hamiltonian must be considered as the equations which are rather postulated than correctly derived. There are also obtained generalized dispersion relations. (auth)

18265

PLASMA OSCILLATIONS. K. M. Case (Univ. of Michigan, Ann Arbor). Ann. Phys. (N. Y.) 7, 349-64 (1959) July.

The equivalence of the Landau and Van Kampen treatments of the initial value problem for plasma oscillations is demonstrated. Using completeness and orthogonality theorems for the normal modes, an integral representation for the solution of the initial value problem is obtained which is shown to be identical with that obtained by modifying the integration

contour in Landau's Laplace Transform solution. (auth)

18266

SYSTEMATIC STUDY OF ELECTRON BINDING ENERGIES OF SOME FOURTH AND SIXTH PERIOD ELEMENTS BY MEANS OF THE PHOTO ELECTRON METHOD. Evelyn Sokolowski (Uppsala Univ.). Arkiv Fysik 15, 1-30(1959).

A new precision method of measuring electron binding energies is used in a systematic study of K energies in the fourth and L energies in the sixth period of the periodic table. The results are compared to those obtained by the conventional x-ray absorption method. Discrepancies are observed in some cases, which motivates a reconsideration of the fundamental processes involved in the two methods. The use of infinitely thick sources in β spectroscopy is demonstrated. (auth)

18267

A STUDY OF THE TEMPERATURE DEPENDENCE OF THE ELEMENTARY EXCITATIONS IN HELIUM II BY THE USE OF COLD NEUTRONS. Karl-Erik Larsson and Kåre Otnes (AB Atomenergi, Stockholm). Arkiv Fysik 15, 49-63(1959).

The dispersion curve of the elementary excitations was studied by observing the angular and energy distribution of cold neutrons scattered from liquid helium in the momentum region $1.44 \leq T \leq 2.37$°K at a helium temperature up to 1.8°K. Parameters of the dispersion curve, such as width of the roton line and minimum excitation energy Δ in the roton region, were determined. In line-width determination the experimental values are about three times as large as theoretically predicted ones. Taking temperature variation into account, the experimental dispersion curve agrees well with the predicted curve. (C.J.G.)

18268

A STUDY OF THE PHOTOELECTRIC EFFECT AND ITS APPLICATION TO THE DETERMINATION OF GAMMA-RAY INTENSITIES. Sölve Hultberg (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 307-53(1959).

A beta-spectrometric study of the longitudinal angular dependence (the θ-dependence) of the photoelectric effect is reported. The K, L, and M + N + ••• shells of the uranium atom have been studied in the complete angular interval $0 \leq \theta \leq \pi$, at the gamma-ray energies 412, 662, and 1332 kev. The influence on the distributions from the set-up geometry and the scattering is discussed. By carrying out special experiments and performing numerical calculations, using a fast electronic computor, the distorting effects could be partly corrected. The experimental distributions are compared with available theoretical expressions, and the usefulness of the angular functions for (a) the study of relative gamma-ray intensities, (b) the determination of absolute internal conversion coefficients, and (c) the absolute measurement of photoelectric cross sections is discussed. The absorption ratios 79.5 ± 0.6% (K-shell), 14.8 ± 0.5% (L-shell), and 5.7 ± 0.3% (M + N + ••• shells) were found for the uranium atom, independently of energy, giving $\tau_a / \tau_K = 1.26 \pm 0.02$. The accuracy of available photoelectric cross sections is discussed and is considered to be about 5%. Practical formulas are given for the correct deduction of gamma-ray intensities from photolines. For the latter purpose the measured angular functions are given numerically in a table, for all angles θ. The case of rectangular shapes of the gamma-ray source and the converter is considered, with no restrictions being imposed on the relative dimensions, i.e., the source may even be larger than the converter. The latter generalization is valid inside an approximation that is fulfilled in most practical cases. Apart from the errors in the evaluation of the photoline intensities and in available τ_K-values the application of the present technique to the analysis of photolines is expected to be accurate to within 1 to 5%, depending on the geometry and the accuracy in the determination of certain parameters. The method for taking the finite dimensions of the source-converter geometry into account has been tested experimentally and was found to be satisfactory. From the tabulated angular functions, K/L, K/(M + N + •••) and L/(M + N + •••) ratios for external conversion in uranium can be obtained for any practical source-converter geometry. (auth)

18269

ABSOLUTE DETERMINATIONS OF K-SHELL PHOTOELECTRIC CROSS-SECTIONS FOR URANIUM AT THE GAMMA-RAY ENERGIES 1173 AND 1332 kev. Sölve Hultberg and Rune Stockendal (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 355-60(1959).

Photoelectric K-shell cross sections for uranium have been determined absolutely at the gamma-ray energies 1173 and 1332 kev by the beta-spectrometric comparison of conversion lines and photolines. The results are $\tau_{K,1173} = 7.2 \pm 0.5$ barns and $\tau_{K,1332} = 5.4 \pm 0.3$ barns. These values agree with τ_K as inferred from the tables of White (NBS Circular No. 583, 1957) to within 5%. The present paper is a report of the first application of a new technique for the determination of τ_K. Advantages and limitations of the method are discussed. (auth)

18270

K AND L ENERGY LEVELS IN SOME FOURTH AND FIFTH PERIOD ELEMENTS. Carl Nordling (Univ. of Uppsala). Arkiv Fysik 15, 397-429(1959).

The photoelectron method has been applied to a study of the binding energies of K and L electrons in the elements copper, zinc, gallium, germanium, and selenium and L binding energies in the elements rhodium through tellurium. Calibration lines are obtained from "absolute" Bρ determinations, and the relative accuracy in the subsequent measurements is 2×10^{-5}. The results are given together with representative x-ray data in modified Moseley diagrams. Discontinuities are observed in these curves even as new subshells of the free atom start to build-up. Certain discrepancies seem to exist between the energies obtained with the photoelectron method and those determined by the conventional x-ray absorption method. (auth)

18271

ELECTRON BINDING ENERGIES IN URANIUM. Carl Nordling and Stig Hagström (Univ. of Uppsala). Arkiv Fysik 15, 431-43(1959).

The L_{II}, $M_{II} - M_V$, and $N_I - N_V$ level energies in uranium have been measured with the photoelectron method. Only a minority of the corresponding x-ray absorption edges have been observed. The binding energies of these shells, which range from 17 kev down to 700 ev, have been determined in this study with an accuracy of a few tenths of an electron volt. Energy values of the K and L levels are deduced by adding energies of x-ray lines to the pertinent binding energies as measured in the present investigation, and an observed discrepancy for the L_{III} energy is discussed. (auth)

18272

INDUSTRIAL PRODUCTION OF HEAVY WATER. K. I. Sakodynskii. Atomnaya Energ. 6, 14-20(1959) Jan. (In Russian)

Data are presented on heavy water production and consumption by various countries. A short survey is given of the efficiency of various industrial installations and the plans for future heavy water output. (R.V.J.)

18273

NEUTRON MODERATION LENGTHS. V. P. Kochergin and V. V. Orlov. Atomnaya Energ. 6, 34-41(1959) Jan. (In Russian)

An approximate solution was derived for integral equations for spatial moments of the neutron distribution function for an infinite medium. The energy and angular moments of neutron scattering are expressed by the experimentally determined angular distribution of various energy groups in the case of anisotropic elastic scattering. The data on total cross sections and angular distributions in elastic scattering on B^9, C^{12}, D, H^1, and O^{16} nuclei were used in estimating the moderation length of neutrons in water, heavy water, graphite, beryllium, and beryllium oxide moderators. (R.V.J.)

18274

γ-RAYS IN A NUCLEAR EXPLOSION. O. I. Leipunskii. Atomnaya Energ. 6, 49-56(1959) Jan. (In Russian)

An analysis was made of the physical factors involved in γ radiation induced by nuclear explosions. The effects of hot air, shock waves, and radiation capture on γ dose were estimated. It is shown that with time γ dosage reaches a maximum and a minimum. A strong γ component was observed at great distances. (R.V.J.)

18275

RESONANCE PROCESSES IN MAGNETIC TRAPS. B. V. Chirikov. Atomnaya Energ. 6, 630-8(1959) June. (In Russian)

Resonance processes between charged particle rotations in a magnetic field and slow vibrations along the magnetic lines were analyzed. It is shown that under certain conditions the resonances can cause complete energy exchange between degrees of freedom, resulting in escape from the trap. The effects of resonances on adiabatic processes related to field time variations are studied. (tr-auth)

18276

INDUCTIVE SELF-ACCELERATION OF CHARGED PARTICLES. G. A. Askar'yan. Atomnaya Energ. 6, 658-9(1959) June. (In Russian)

Attempts to create powerful gas discharges usually result in plasma currents in which the electrons have relatively small velocity but possess large stored energies in their magnetic fields. An analysis is made of some processes for utilizing these energies for acceleration or for achieving higher current densities. (R.V.J.)

18277

PROTECTION OF RECTANGULAR SHAPED γ RADIATION SOURCES. D. P. Osanov and E. E. Kovalev. Atomnaya Energ. 6, 670-2(1959) June. (In Russian)

The attenuation from rectangular γ sources of finite dimensions was studied, assuming the source as an infinitely fine emitting plate with evenly distributed active material on the surface. Nomograms are given for calculating attenuation in shielding, and the dose rates at various distances are plotted. (R.V.J.)

18278

EFFECTS OF BOUNDARY CONDITIONS ON THE γ RAY ATTENUATION FACTOR. V. M. Kodyukov. Atomnaya Energ. 6, 673-4(1959) June. (In Russian)

The effects of boundary conditions on the γ attenuation factor were determined. It was found that the γ attenuation factor is at a minimum in infinite media and at a maximum in the barrier geometry, though the thickness of the absorption material is identical. The difference between the attenuation factors varies inversely with γ energy. In semifinite media the attenuation factor has an intermediate value. (R.V.J.)

18279

ON THE PROPAGATION OF SHOCK-WAVES IN A NON-HOMOGENEOUS ELASTIC MEDIUM. E. Sternberg and J. G. Chakravorty. Bull. acad. polon. sci., Sér. sci., tech. 7, 183-5(1959).

Solutions are given for the propagation of shock waves in isotropic, inhomogeneous elastic materials. (C.J.G.)

18280

THE MÖLLER SCATTERING OF ARBITRARILY POLARIZED ELECTRONS. R. Rączka and A. Rączka (Univ. of Warsaw). Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 6, 463-8(1958).

The general covariant formula for the cross section of the Möller scattering is obtained. Then, the special case of transverse polarization is discussed. The experimental conditions are found that are to be satisfied if the Möller scattering is to be used for the measurement of the transversal component of the polarization vector. The relative magnitude of polarization effects is discussed as a function of the scattering angle and energy. (auth)

18281

EXCITED LEVELS OF NUCLEI WITH MIXED CONFIGURATIONS. II. NUMERICAL EXAMPLE. Z. Szymański (Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 6, 469-75(1958).

A numerical example is given to illustrate considerations given previously. Even-even nuclei with 4 external nucleons are considered: $2(1p_{3/2})$ protons and $2(0f_{5/2})$ neutrons. The choice of $j_p = 3/2$, $j_n = 5/2$ corresponds to the lowest possible values of angular momenta. Furthermore, a relatively considerable overlapping of harmonic oscillator configurations (1p) and (0f can be expected. Finally, it is believed that there are actually some nuclei with external protons and neutrons in the two configurations, respectively. This occurs in the mass region of about $A \sim 66$. Zero-range residual interactions are assumed in the first stage. It is believed that this will be a good approximation. The finite range interactions, however, do not lead to any more computational difficulties. For the δ-forces it is sufficient to take for the interactions only a mixture of the Wigner and the Bartlett forces. The ratio of the two above named contributions is treated as a variable parameter. (auth)

18282

TRANSITION MATRICES FOR REACTIONS BETWEEN TWO BOSONS AND TWO FERMIONS. J. Werle (Polish Academy of Sciences, Warsaw). Bull. acad. polon. sci., Sér. sci., math., astron. et phys. 6, 477-9(1958).

A previously given general expression for the transition matrix M describing arbitrary processes between two bosons and two fermions is investigated. (T.R.H.)

18283
CALCULATION OF THE THERMAL CONDUCTIVITY OF AN IONIC CURRENT. Henri Cabannes. Compt. rend 249, 47-9(1959) July 6. (In French)

Kinetic theory methods are used to calculate the thermal conductivity tensor of the ionic part of a plasma. The results are explicit in the case of an interaction of the Maxwell type. (tr-auth)

18284
CONSTRUCTION OF QUADRUPOLAR MAGNETIC LENSES WITHOUT IRON. Albert Septier and Germain Chartier (Faculté des Sciences, Paris). Compt. rend. 249, 64-6(1959) July 6. (In French)

Magnetic field distributions with quadrupolar symmetry due to linear currents or surface currents were studied. This solution leads to a satisfying approximation of the ideal distribution with constant radial gradient and permits consideration of strong-focusing lenses without iron. (tr-auth)

18285
NUCLEAR ORIENTATION OF Hg^{201} AND Hg^{199} BY OPTICAL PUMPING AND MEASUREMENT OF THEIR MAGNETIC MOMENTS BY NUCLEAR MAGNETIC RESONANCE. Bernard Cagnac and Jean Brossel. Compt. rend. 249, 77-9(1959) July 6. (In French)

The nuclear orientations of Hg^{201} and Hg^{199} were obtained by optical pumping. The magnetic moments μ_{201} and μ_{199} were measured. Their ratio ($\mu_{201}/\mu_{199} = 1.10741 \pm 1$) indicates the existence of a hfs anomaly. (tr-auth)

18286
ACCOMPLISHMENT OF AN AUTO-OSCILLATOR OF THE MASER TYPE IN A STRONG FIELD. Claude Fric. Compt. rend. 249, 80-2(1959) July 6. (In French)

An auto-oscillator of the maser type is described which uses protons from a current of polarized water. The operation is stable and without parasitic modulation. The frequency of the maser is 29.66 MHz corresponding to a field of 6980 gauss. (tr-auth)

18287
THE STRUCTURE OF CERTAIN RADIOACTIVE POWDERS. Marcel Guillot and André Delaval (Faculté de Pharmacie, Paris). Compt. rend. 249, 85-7(1959) July 6. (In French)

It was shown by the use of nuclear α plates that the aerosol resulting from transformation in air of emanations in the form of active deposits is made up of solid particles suspended in a radioactive gas the atoms of which remain separate. (tr-auth)

18288
MEASUREMENT BY WEIGHING OF THE AVERAGE DENSITY OF A LIQUID–GAS EMULSION IN VERTICAL MOTION IN A PIPE. Henri Mondin and Philippe Vernier. Compt. rend. 249, 227-9(1959) July 15. (In French)

An air–water emulsion of known density was needed to calibrate a gamma-ray densitometer for use in experimental channels of boiling nuclear reactors. A double weighing scheme and apparatus are described which accomplished the desired results. The apparatus permits weighing of an emulsion in horizontal flow and permits, vertically or horizontally, various double-phase hydrodynamic studies. Using the apparatus, one can calculate the speed of slipping of a gas with respect to a liquid starting with the respective flows of the two phases and the density of the emulsion they form. (T.R.H.)

18289
ENERGETIC LIMITS OF THE ELECTRO-INTENSIFICATION AND ELECTRO-EXTINCTION EFFECTS. Georges Destriau. Compt. rend. 249, 245-7 (1959) July 15. (In French)

Under the influence of electric fields, luminescent compounds of the type CdZnS:Mn,X have either an increased sensitivity (excitation by x rays, electro-intensification effect) or a reduced sensitivity (excitation by ultraviolet, electro-extinction effect). For a region of intermediate excitation one should not expect any effect. This limit appears to be near 5,000 ev. (tr-auth)

18290
THE NOVEL EFFECT OF SENSITIZATION TO X RAY EFFECTS BY INFRARED OF LUMINESCENT PRODUCTS OF THE TYPE CdZnS:Mn,X. Francois Pingault. Compt. rend. 249, 248-50(1959) July 15. (In French)

It was found that infrared radiation produces a permanent increase in the sensitivity to x rays of CdZnS:Mn,X. This infrared effect is analogous to that of an electric field, the emission bands being deformed in the same manner in both cases. Comparison of a plot of increase in sensitivity versus infrared intensity with a similar plot for the electric effect further verifies their similarity. The two phenomena are both represented by a simple modification of the amplitude of the luminescence waves but without any deformation. (T.R.H.)

18291
SPECTROGRAPHIC STUDY OF TWO LUMINOGENES OF CADMIUM IODIDE ACTIVATED BY LEAD. Gabriel Monod-Herzen. Compt. rend. 249, 251-2 (1959) July 15. (In French)

A previous study of the luminescence of $CdI_2(Pb)$ in Wood's light led to prediction of the existence of two luminogeneous complexes. To confirm this, absorption spectrum studies of concentrated solutions of CdI_2 with and without additions of PbI_2 were conducted. Curves of wavelength versus intensity for increasing amounts of PbI_2 are given. If the compounds studied have two distinct luminogens, one can expect that each of the curves can be considered as the sum of two simple curves corresponding each to one of the two complexes. The fact that the influence of the PbI_2 is considerable in the presence of CdI_2, while a solution of PbI_2 alone 30 times more concentrated is transparent in this region, confirms the formation of one or more complexes. The beginning of this effect near 400 mμ corresponds to the directly determined excitation threshold. The position of the supplementary absorption maximum near the wavelength of the strongest line of the spectrum of Wood's light (365 mμ) explains the intensity of the excitative effect of this light. (T.R.H.)

18292
THE EFFECT OF ELECTROMAGNETIC FIELD ON DETONATION. G. A. Lyubimov (Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 532-3(1959) May 21. (In Russian)

In order to solve the problem of detonation wave propagation along a gas in an electromagnetic field, the gas conductance following the detonation wave should be taken into account. An analysis is made of a stationary detonation wave. The gas conductance in front of the wave is equal to zero ($\sigma_1 = 0$); the conductance following the wave is considered infinite ($\sigma_2 = \infty$). (R.V.J.)

18293
ON THE THEORY OF GREEN'S TEMPERATURE FUNCTIONS. V. L. Bonch-Bruevich (Lomonosov Mos-

cow State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 539-42(1959) May 21. (In Russian)

Green's function correlations were developed for the effective wave relation and for the pulse distribution function in a nondegenerate electron gas. (R.V.J.)

18294

A NEW FORM OF POLAR CRYSTAL MODEL. A. E. Glauberman, V. V. Vladimirov, and I. V. Stasyuk (Ivan Franko L'vov State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 543-5(1959) May 21. (In Russian)

A new polar model was applied for solving certain problems related to the processes of transition in solid matter. The problems formulated in terms of elementary excitations (quasi particles) and consequent partition of the Hamiltonian describing elementary excitations based on the Shubin-Vonsovskii polar method was found to be complicated. An atomic crystal with a single-valency s electron for each atom was used in illustrating the new transition scheme. By limiting the study to s-electron states, the polar excitations are expressed by pairs and holes and are Fermi-type operators. The excitation Hamiltonian is derived automatically and simply by transforming the developed relations. (R.V.J.)

18295

GREEN'S QUANTUM TEMPERATURE FUNCTIONS. Sh. M. Kogan (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 546-9(1959) May 21. (In Russian)

The thermodynamic properties of quantum systems are studied by the method of Green's function generalization for systems with arbitrary temperatures $T > 0$. The quasi-closed system of Fermi particles with electromagnetic interaction is analyzed. (R.V.J.)

18296

INTERMEDIATE SYSTEMS IN QUANTUM ELECTRODYNAMICS. M. S. Livshits (Khar'kov Mining Inst.). Doklady Akad. Nauk S.S.S.R. 126, 550-3(1959) May 21. (In Russian)

The expressions for matrix elements of various processes in quantum electrodynamics were derived, based on the intermediate system concept. Investigations were made of the two free particles α_1 and α_2 (photons, electrons, or positrons) which are assumed to be scattered according to a scheme in which α_1 and α_2 disappear and an intermediate system c ($\alpha_1' + \alpha_2' \rightarrow c$) simultaneously appears or where the intermediate system c disappears and a new state ($c \rightarrow \alpha_1'' + \alpha_2''$) appears. (R.V.J.)

18297

THE FINE STRUCTURE OF X-RAY ABSORPTION K-SPECTRA OF TITANIUM IN TITANATES OF THE $BaO-TiO_2$ SYSTEM AND ITS RELATION TO THE NATURE OF THE POLARIZATION OF ATOMS IN ROCHELLE SALT DIELECTRICS. E. E. Vainshtein, M. N. Bril, and Yu. F. Kopelev (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 744-7(1959) June 1. (In Russian)

An attempt is made to utilize the fine x-ray absorption spectrum of seignettoelectric materials for estimating the symmetry and magnitudes of the internal field in crystals. The x-ray spectra of metatitanate ($BaO \cdot TiO_2$), dititanate ($BaO \cdot 2\ TiO_2$), tetratitanate ($BaO \cdot 4\ TiO_2$), and titanate were studied, and the absorption K spectra of titanium was scaled to an electrovolt scale. (R.V.J.)

18298

MOMENT APPROXIMATION METHOD IN GENERALIZED HYDRODYNAMICS. I. I. Olkhovskii (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 748-51(1959) June 1. (In Russian)

A method is derived for solving the Boltzmann kinetic equation without special summations for ϵ. (R.V.J.)

18299

EQUATION FOR THE WAVE FUNCTION OF A SYSTEM OF N PARTICLES IN THE PROBLEM OF MANY BODIES. V. G. Solov'ev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 755-8(1959) June 1. (In Russian)

In previous work N. N. Bogolyubov (Doklady Akad. Nauk 119, 244, 1958) suggested a generalization for the Fock method in which the energy minimum is found in the individual particle quasi-independent functions. The suggested variation utilizes a wider span of functions which consider the wave functions of particle pairs in addition to the quasi-independent functions of individual particles. The new variation is used for deriving the equations for a wave function of N particle systems in the many-body problem. The new principle and mathematical method permit both particle pair and N particle system correlations. It is pointed out that while the number of particles in spatially uniform problems is conserved, in spatially non-uniform problems it is not. (R.V.J.)

18300

CALCULATION OF THE REPEATED SCATTERING OF GAMMA RAYS OF URANIUM AND THORIUM FAMILIES. A. N. Orlov, V. S. Galishev, and G. G. Taluts (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 975-8(1959) June 11. (In Russian)

Some new methods and results of calculations for multiple scattering of uranium and thorium γ rays (in equilibrium with decay products) in the simplest geometric conditions are suggested for application in geophysical prospecting. The calculations consider the more intense spectrum lines at $E > 0.5$ Mev. The obtained data are tabulated. Analysis was made of point source spectra in an infinite medium and in multilayer absorbers. (R.V.J.)

18301

NEW FRONTIERS FOR SEMICONDUCTORS. Charles A. Escoffery (International Rectifier Corp., El Segundo, Calif.). Electronics 32, No. 29, 43-7(1959) July 17.

A detailed study is made of the periodic table to aid in understanding the relationship between the various elements and their performance in semiconductor devices. Examination shows that other semiconductor elements besides the relatively well-known ones are possible. (C.J.G.)

18302

ABSOLUTE MEASUREMENT OF THE INTENSITY OF NEUTRON SOURCES. E. Germagnoli (CISE, Milan and Istituto di Fisica del Politecnico, Milan). Energia nucleare (Milan) 6, 429-40(1959) July. (In Italian)

A few typical methods of absolute calibration of neutron sources are reviewed, and intercalibrations between standard sources are considered in some detail. The limits of accuracy which can actually be obtained in such measurements are deduced. (auth)

18303

AN INVESTIGATION OF ELECTROLUMINESCENCE

OF MONOCRYSTALS ZnS, CuCl. V. E. Oranovskii, E. I. Panasyuk, and B. T. Fedyushin (Lebedev Inst. of Physics, Moscow). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 1, 39-45(1959) Jan. (In Russian)

It is once more directly demonstrated that in monocrystals radiation is localized to a very small fraction of the volume of the crystal. It is found that excitation is clearly anisotropic, depending on the direction of the field with relation to the crystal, indicating that only a component of the field along the main growth axis of the crystal can perform this function. It is shown that electroluminescence arises at a single point only where the direction of the field is fully determined, and that the neighbouring points on the line are stimulated in counterphase. It is shown that the relationship of intensity of electroluminescence to the voltage and frequency, both for the monocrystal as a whole and for its individual parts with a large number of points, fit into the analytical relationship obtained for powder electroluminophors. A model of the inner structure of the crystal is proposed, which qualitatively explains the results of experiments. (auth)

18304

THERMAL MOTION IN ICE AND HEAVY ICE. Alfred Zajac (Polytechnic Inst. of Brooklyn). J. Chem. Phys. 29, 1324-7(1958) Dec.

Changes with temperature of x-ray intensities of the 00*l* reflections in ice and heavy ice are investigated. From these the amplitudes of thermal motion of oxygen and hydrogen atoms are determined separately. This can be accomplished since only hydrogen atoms contribute to the 004 reflection. The thermal amplitudes of the oxygen atoms, which represent molecular amplitudes, can be expressed in terms of a constant Debye characteristic temperature; 224°K for ordinary ice and 237°K for heavy ice. The amplitudes of thermal vibration of the hydrogen and deuterium atoms as derived from absolute intensities of 004 at various temperatures, cannot be expressed in terms of a characteristic temperature. They consist of superimposed stretching, bending, and librational motions. In addition to these a rotational motion of low zero point energy seems to be present. (auth)

18305

ELECTRON DIFFRACTION OF ZINC SILICATE PHOSPHOR. S. Yamaguchi (Inst. of Physical and Chemical Research, Tokyo). J. Electrochem. Soc. 106, 735-6 (1959) Aug.

A commercial sample of zinc silicate phosphor (Zn_2SiO_4:Mn), in powder form and of unknown history was studied by electron diffraction using two different wave lengths (0.029 and 0.0455A). Electrons accelerated to 150 kv or more can penetrate thick grains to a depth of about 3000A, whereas soft electrons at about 50 kv can only graze their surfaces. The thickness of the surface layer which can be penetrated by the latter electrons is about 200A. The diffraction patterns observed at the same spot of the sample with the soft and hard electrons are given. (auth)

18306

ALPHA FINE STRUCTURE OF Bi^{210} (RaE). R. J. Walen and G. Bastin-Scoffier. J. phys. radium 20, 589-93 (1959) June. (In French)

The α-ray structure of Bi^{210} (Ra E) is determined by means of magnetic spectrography. Two groups are observed with following energy and abundance: 4.686 Mev, 0.5×10^{-6} and 4.649 Mev, 0.75×10^{-6}. The results are discussed in terms of possible structure of Tl^{206} and Bi^{210}. (auth)

18307

A JET SHOWER WITH ENERGY OF 5×10^{13} ev FOUND IN EMULSION CHAMBER. Kiyoshi Nishikawa (Wakayama Univ., Japan). J. Phys. Soc. Japan 14, 880-87 (1959) July.

A high-energy jet shower suitable for detailed analysis was found in one of the emulsion chambers flown in 1956 as the "Emulsion Chamber Project." The charged secondary particles of this jet were analyzed in the usual way, and the energy of π^0 mesons was determined by making use of the cascade showers developed from the γ rays decayed from these π^0 mesons. The energy of incident particles was obtained by the use of usual median angle method, and was estimated to be 5×10^{13} ev ($\gamma_c = 165$). By making use of the fact that transverse momenta of points are constant and by analyzing cascade showers developed from γ rays produced by the decay of π^0 mesons, the energy of secondary particles was estimated. It was thus found that the differential momentum spectrum obtained is of the form dP/P^3. Also inelasticity coefficients K′, K″, and K in the definition of the Bristol group were estimated to be 0.15, 0.10, and 0.5, respectively. Further, the results of the analysis were compared with various theories. (auth)

18308

INTEGRALS IN THE THERMOELECTRIC POWER OF SEMICONDUCTORS. Kimio Hashimoto. Mem. Fac. Sci., Kyushu Univ. Ser. B 2, 165-70(1958) Dec.

A general formula is presented for the thermoelectric power Q of non-polar and isotropic semiconductors. (W.L.H.)

18309

A PROPOSAL OF A GAMMA-SOURCE WITH IMPROVED HOMOGENEITY OF RADIATION FIELD. Kenzi Hukuda. Mem. Fac. Sci., Kyushu Univ. Ser. B 2, 171-3(1958) Dec.

The source considered is divided into two equivalent cylinders, and they are arranged coaxially with a narrow gap between the inner ends of the cylinders. The method of calculating the dose rate at any position in the neighborhood of a cylindrical source is given. The contributions of the divided two portions of the source should be computed separately and then superposed. The distributions of the radiation intensities for an improved source which consists of two circular cylinders whose length-to-radius ratio is equal to 1.5 are shown. (W.L.H.)

18310

ON THE Mn-ACTIVATED PHOSPHORS. On Matumura. Mem. Fac. Sci., Kyushu Univ. Ser. B 2, 175-86(1958) Dec.

Some physical properties including electron spin resonance of Mn-activated phosphors are measured and discussed. (W.L.H.)

18311

ELECTRICAL PROPERTIES OF BISMUTH SELENIDE, Bi_2Se_3. II. THERMOELECTRIC POWER AND THERMAL CONDUCTIVITY. Kimio Hashimoto. Mem. Fac. Sci., Kyushu Univ. Ser. B 2, 187-93(1958) Dec.

The thermoelectric power and its relationship to the Hall effect and electrical conductivity were studied. The thermal conductivity of Bi_2Se_3 was also investigated. (W.L.H.)

18312

A SIMPLE DEUTERIUM EXCHANGE METHOD FOR USE IN INFRARED SPECTROSCOPIC STUDY OF MOLECULAR STRUCTURE. H. Hoyer. Monatsh. Chem. 90, 357-60(1959). (In German)

Infrared spectroscopic detection of deuterium exchange in X–H bonds can be considerably simplified by giving up the isolation of the deuterated compound, if one uses a quartz couvette for the deuterium exchange. (tr-auth)

18313

SPECIFIC TOTAL IONIZATION AND IONIZATION ENERGY OF 15-Mev ELECTRONS IN AIR AND OTHER GASES. B. Markus (Universitäts-Hautklinik, Göttingen, Ger.). Naturwissenschaften 46, 397-8(1959). (In German)

An apparatus which directly measures a definite fraction of the specific total ionization (S) of fast electrons in gases (a parallel-plate ionization chamber with a vertical field for a focused electron beam; behind this is a Faraday cage for measurement of the ionizing electron beam) was used to determine the value of the "measured specific ionization" for 14.8-Mev electrons from a betatron. It was found that the relative efficiency depends very weakly on the form and dimensions of the ionization volume; also, the filling gas has a slight effect. Values obtained for S are (in cm^{-1}): H_2, 13.0 ± 0.8; N_2, 79.9 ± 5.0; Ar, 131.4 ± 8.0; CH_4, 77.2 ± 4.6; and air, 83.6 ± 5.0. Values found for ionization energy ϵ are (in ev): H_2, 31.6 ± 1.9; N_2, 32.3 ± 1.9; Ar, 23.7 ± 1.4; CH_4, 25.1 ± 1.5; and air, 31.9 ± 1.9. (T.R.H.)

18314

RESEARCH ON ATOMIC LENGTH STANDARDS. Nuclear Energy Engr., 354-6(1959) July.

Approaches for improving length standards are under study. These are the atomic beam and the Zeeman absorption filter. In an atomic-beam device used as an emission source, the mercury atom to be excited is heated in an oven to a temperature of about 105°C. Atoms emerging from the oven pass through a collimating slit into the interaction region. The resulting atomic beam is excited by an electron bombardment. Another approach uses the atomic beam as an absorption device. The atoms in the atomic-beam vapor absorb energy at wave lengths in the vicinity of their resonant transitions. The absorption line is extremely narrow (0.002 cm^{-1}) and corresponds to the projected Doppler width. In interferometry the absorption line is much less satisfactory than an emission line. The Zeeman absorption filter consists of a mercury cell suspended between the poles of an electromagnet. The action of this filter depends on the Zeeman effect, the splitting of spectral lines in a magnetic field. Both approaches have proved successful in producing very narrow lines whose wave lengths can be precisely determined. (C.J.G.)

18315

POLARIZATION EFFECTS IN MOTT SCATTERING. H. Schopper (Institut für Kernphysik, Mainz). Nuclear Phys. 11, 675-86(1959) June (2). (In German)

A complete verification of the theory for electron scattering by nuclei can only be performed if at least three quantities are observed: the differential scattering cross section, the electron polarization perpendicular to the scattering plane and the change of an initial polarization in the scattering plane. Only the first two experiments have been performed up to the present time. However, in the light of the parity experiments it seems now feasible to observe at the same time the polarization before and after the scattering. The effects to be expected were calculated for unscreened nuclei. In contrast to the well known polarization effects perpendicular to the scattering plane there is only a small Z-dependence for the change of polarization in the scattering plane. Thus polarization effects can be investigated also for low values of Z. Experimental arrangements are proposed. (auth)

18316

THE ALTITUDE DEPENDENCE OF ATMOSPHERIC COSMIC-RAY NEUTRONS AND THE SLOW NEUTRON DENSITY BELOW A WATER SURFACE. R. D. Edge (Australian National Univ., Canberra, Australia). Nuclear Phys. 12, 182-9(1959) July (1).

The altitude dependence of atmospheric cosmic-ray neutrons over Canberra has been found to be $\exp[-x/160]$ where x is the atmospheric depth in g/cm^2. The Szilard-Chalmers reaction in a sodium permanganate solution was employed as the neutron detector, and its advantages for the absolute measurement of the cosmic-ray neutron flux are discussed. A similar technique was used to determine the slow neutron flux just below a water surface. (auth)

18317

COMPARISON THEOREMS FOR THE ESTIMATION OF AVERAGE COLLISION PROBABILITIES. Lawrence Dresner (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 6, 63-5(1959) July.

Three theorems are given which permit the estimation of average collision probabilities for convex solids of irregular shape by comparison with solids for which the average collision probability is known. (auth)

18318

SOLUTIONS OF THE CONSTANT VELOCITY TRANSPORT PROBLEM. L. A. Beach, P. Shapiro, R. C. O'Rourke, W. R. Faust, and B. Lepson (Naval Research Lab., Washington, D. C.). Nuclear Sci. and Eng. 6, 66-75(1959) July.

By Fourier transform techniques the exact solutions of the one-velocity neutron diffusion problem for a uniform infinite medium with isotropic scattering have been derived for plane isotropic, plane parallel monodirectional, and plane parallel bidirectional source terms. These exact solutions in terms of Fourier inversion integrals were numerically evaluated upon the NAREC to give the angular distribution of the scattered intensity, the total scattered intensity, and the total intensity. By solving the integrals by contour integration in the complex plane, asymptotic solutions were obtained which are good approximate solutions for deep penetrations and problems with little absorption. (auth)

18319

THERMAL NEUTRON INELASTIC SCATTERING EFFECTS IN A SINGLE CRYSTAL NEUTRON SPECTROMETER. V. P. Duggal (Atomic Energy Establishment, Trombay, India). Nuclear Sci. and Eng. 6, 76-8(1959) July.

The thermal neutron spectrum emerging from the "Apsara" reactor was measured with a single-crystal spectrometer. The curve of neutron counting vs. Bragg angle showed fluctuations which were much higher than the statistical errors. Similar fluctuations have been reported by other investigators. The course of these fluctuations had not been understood so far. It is shown that these fluctuations are due to inelastic scattering of thermal neutrons by the crystal. The experimental

work is described. The results of calculations are graphically shown. (A.C.)

18320

THE AGE OF U^{233} FISSION NEUTRONS IN WATER. Martin Faber and P. F. Zweifel (Univ. of Michigan, Ann Arbor). Nuclear Sci. and Eng. 6, 81(1959) July.

Results indicate that the age of U^{233} fission neutrons is probably 8 or 9% lower than the age of U^{235} fission neutrons. (C.J.G.)

18321

NOTE ON POSITION-DEPENDENT SPECTRA. W. B. Wright and F. Feiner (General Electric Co., Schenectady, N. Y.). Nuclear Sci. and Eng. 6, 81-2(1959) July.

Expressions that yield a method of calculating the peaking and relaxation length of a transient generated by a slab gap are given. Calculations using these expressions are compared with experimental relaxation lengths. (C.J.G.)

18322

THE RELATION BETWEEN REACTOR PERIOD AND MULTIPLICATION FACTOR IN SUBCRITICAL STATE. Wiktor Baran (Instytut Badań Jądrowych PAN, Warsaw). Nukleonika 4, 253-64(1959). (In Polish)

The expression for the reactor period T as a function of the multiplication factor in subcritical state (i.e., before attaining $k_{eff} = 1$) was found. It is possible to prepare T(k) diagrams in order to gage the reactivity meter and the reactor periodmeter. (auth)

18323

METHOD OF THE INVESTIGATION OF DOMESTIC URANIUM ORES AND ITS RESULTS. Karol Pinkas (Instytut Badań Jądrowych PAN, Warsaw). Nukleonika 4, 265-70(1959). (In Polish).

A method has been worked out for the investigation of samples from new uranium deposits. The method consists in leaching of these samples by dilute sulfuric acid, nitric acid, and alkaline solutions. The method makes it possible to obtain technological data necessary for the estimation of the new ore deposits. The method is very simple and has been applied to samples from new domestic uranium deposits which have been qualified as very valuable. (auth)

18324

ABSOLUTE METHODS OF MEASUREMENT OF ACTIVITY OF β AND γ-EMITTERS. Tomasz Radoszewski (Instytut Badań Jądrowych PAN, Warsaw). Nukleonika 4, 271-84(1959). (In Polish)

A review of the usefulness and accuracy of methods for absolute measurements of the activity of isotopes is given. The solid angle and $\beta-\gamma$ coincidence methods are described and results compared with the results of measurement of standards from The National Physical Laboratory, England. (auth)

18325

HALOGEN–QUENCHED G-M COUNTERS. Jan. Lesiński (Instytut Badań Jądrowych PAN, Warsaw). Nukleonika 4, 285-303(1959). (In Polish)

The mechanism of discharge and the properties of counters with halogen quenching are described. The phenomenon of spreading of the discharge along the whole anode and the influence of metastable states of the main gas on amplitude and build up time of voltage pulse are discussed. (auth)

18326

NUCLEAR PROPULSION IN MERCHANT FLEET. Józef M. Pawlikiewicz (Instytut Badań Jądrowych PAN, Warsaw). Nukleonika 4, 305-22(1959). (In Polish)

Application of nuclear propulsion to the merchant fleet is determined by greater economical effects. Some types of ships are discussed which offer the greatest economical promise when nuclear propulsion is used. General characteristics of the most adequate reactors to install in the ship are presented. The weights of conventional and nuclear power plants are compared together with expected economical effects. Finally, an efficiency comparison is made for both kinds of propulsion in a tanker. (auth)

18327

THE WORLDWIDE DISTRIBUTION OF THE F2 LAYER ELECTRON DENSITY: SEASONAL AND NON-SEASONAL VARIATIONS AND CORRELATIONS WITH SOLAR ACTIVITY. F. Mariani (Istituto Nazionale di Geofisica, Rome and Università, Rome). Nuovo cimento (10) 12, 218-40(1959) May 1.

The worldwide behavior of the twelve-month period (seasonal and non-seasonal) variation of the maximum electron density N in the F2 layer appears noticeably different at noon and at midnight. In each case, it is controlled by the geomagnetic field and by the solar activity, and at noon it shows large asymmetric features in the two hemispheres. At midnight, it is fairly symmetrical. It is not possible to account for the experimental results by assuming some external source of radiation producing nonseasonal effects. One is led to assume some terrestrial cause of asymmetry, for example, some effect of general circulation in the upper atmosphere. With respect to the correlation of electron density with solar activity, there appears again some noticeable asymmetry in the two hemispheres; in particular, the northern hemisphere appears more influenced by the solar hydrogen filaments, especially for increasing latitude. The explanation of these asymmetries, in terms of some direct influence of the sun, is also puzzling, so that, in this case, one is led to think of some more or less unknown effect of solar corpuscular (or electromagnetic) radiation on the upper atmosphere, for example on its movements or its conductivity. (auth)

18328

A DECREASE IN THE INTENSITY OF THE COSMIC RADIATION OBSERVED UNDERGROUND, AT SEA LEVEL AND AT MOUNTAIN ALTITUDE. P. Chaloupka and P. Mokrý (Czechoslovakian Academy of Sciences, Prague); T. Kowalski (Polish Academy of Sciences, Krakow); and T. Sándor, A. Somogyi, and F. Telbisz (Hungarian Academy of Sciences, Budapest). Nuovo cimento (10) 12, 639-41(1959) June 16.

A decrease was detected in IGY measurements of cosmic-ray intensity variations of the penetrating component and the low-energy nucleon component beginning rather sharply on March 25, 1958, at (1746 ± 6) min. UT. The decreases were observed underground, at sea level, and at mountain altitude. Plots of the intensity variations are given. (C.J.G.)

18329

PROCEEDINGS OF THE 1958 INTERNATIONAL CONFERENCE ON SEMICONDUCTORS, ROCHESTER, AUGUST 18-22. Phys. and Chem. Solids 8, 1-552(1959) Jan.

Papers were presented on the following subjects at the conference: band theory, recombination and impurity centers, surfaces, theory, dislocations, excitons, transport, optical properties, ionic crystals, magneto-optical effects, thermal conduction and thermomagnetic effects, excitons and photons, semiconducting com-

pounds, large band gap semiconductors, resonance, and galvanomagnetic effects. (W.L.H.)

18330

CHARACTERISTIC MANIFOLDS IN THREE-DIMENSIONAL UNSTEADY MAGNETOHYDRODYNAMICS. Rudi S. Ong (Univ. of Michigan, Ann Arbor). Phys. Fluids 2, 247-51(1959) May-June.

The technique developed in the general theory of discontinuities is applied to the basic equations of unsteady magnetohydrodynamics in order to find the conditions to be satisfied by the discontinuities in the derivatives of the significant flow and magnetic field parameters. In the formulation of the basic equations use is made of the "magnetohydrodynamic approximation." This amounts to the assumption that the magnetic energy is very large compared with the electric energy, or physically, that the displacement current is negligible. The fluid itself is considered to be infinitely conductive, inviscid, and compressible. With the aid of the relations satisfied by the jumps in the derivatives of the parameters the various characteristic manifolds are found. Finally, it is shown that these manifolds are hypersurfaces along which small disturbances and weak shocks are propagated. (auth)

18331

ON THE SPEED OF SOUND IN AIR. R. A. Gross and C. L. Eisen (Fairchild Engine Div., Deer Park, N. Y.). Phys. Fluids 2, 276-9(1959) May-June.

In a high-temperature gas, the speed of sound depends upon the chemical composition, sound frequency, and chemical reaction rates. Two limiting sound speeds are normally distinguished: that of "frozen" or constant chemical composition, and the "equilibrium" sound speed. Equations to determine these two sound speeds are presented for a nitrogen–oxygen system, and numerical data are presented for conditions behind a normal shock in air to a speed of Mach 20. (auth)

18332

SEISMIC SCALING LAW FOR UNDERGROUND EXPLOSIONS. A. L. Latter and E. A. Martinelli (RAND Corp., Santa Monica, Calif.) and E. Teller (Univ. of California, Livermore). Phys. Fluids 2, 280-2(1959) May-June.

Observations indicate that the amplitudes of distant seismic signals from underground nuclear explosions are approximately proportional to the total energy release. It is shown that these observations can be accounted for by a simple model which assumes that the nonlinear region close to the explosion is similar for all explosions and that the linear region transmits only low-frequency waves. (auth)

18333

MECHANISM FOR INSTABILITY OF TRANSVERSE PLASMA WAVES. Burton D. Fried (Space Tech. Labs., Inc., Los Angeles). Phys. Fluids 2, 337(1959) May-June.

Determination is made of the physical mechanism responsible for growing transverse waves resulting from plasma instabilities associated with anisotropic velocity distributions. (C.J.G.)

18334

VISUALIZATION OF CYLINDRICAL SHOCK WAVES. F. D. Bennett and D. D. Shear (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Phys. Fluids 2, 338-9 (1959) May-June.

In a previous paper (Bennett, Phys. Fluids 1, 347 (1958)) a method of mirror back-lighting was introduced to make visible the cylindrical shock waves formed by an exploding wire. An alternative scheme is offered which has the advantage of tracing the path of the shock wave over a longer interval of time than in the earlier method. (L.T.W.)

18335

MULTISTAGE MAGNETIC COMPRESSION OF HIGHLY IONIZED PLASMA. F. H. Coensgen, W. F. Cummins, and A. E. Sherman (Univ. of California, Livermore). Phys. Fluids 2, 350-61(1959) July-Aug.

The mean energy of the charged particles of a plasma which is confined in a magnetic field may be increased by increasing the magnitude of the magnetic field in a time which is short with respect to the ion relaxation time (magnetic compression). It is shown that the necessary stored energy can be reduced and the efficiency greatly increased if the magnetic compression is performed in several stages, such that the plasma is compressed and transferred to successively smaller volumes. The predicted transfer behavior has been confirmed by studying the plasma movement in a three-stage system. In the course of the investigation a plasma source has been developed which provides bursts of plasma of 10^{16} to 10^{18} ions with an average velocity of the order of 10^7 cm/sec. (auth)

18336

MAGNETIC DIFFERENTIAL EQUATIONS. William A. Newcomb (Univ. of California, Livermore). Phys. Fluids 2, 362-5(1959) July-Aug.

A necessary and sufficient condition is derived for a magnetic differential equation $\mathbf{B} \cdot \nabla \mathbf{r} = 0$ to have a single-valued solution $\mathbf{r}$, where B is the field of a magnetohydrostatic equilibrium state or, more generally, any field with a system of toroidal magnetic surfaces. (auth)

18337

PROPAGATION OF WEAK HYDROMAGNETIC DISCONTINUITIES. J. Bazer and O. Fleischman (New York Univ.). Phys. Fluids 2, 366-78(1959) July-Aug.

A theoretical discussion is given of the propagation of weak hydromagnetic discontinuities (e.g., weak shocks) in an infinitely conducting, perfect, compressible fluid. The undisturbed flow is assumed to be steady and isentropic. As in geometrical optics, the wave fronts evolving from a given initial manifold— there will be six of them, in general—are constructed by means of rays. In addition, formulas are derived describing the variation of the discontinuity "strength" of a given propagating mode along rays associated with that mode. These results are employed to obtain an explicit solution of a simple mixed initial, boundary-value problem that has been designed to illustrate (1) a method of producing hydromagnetic disturbances and (2) the fact that an initial disturbance gives rise, in general, to several propagating waves. (auth)

18338

CYCLOTRON RADIATION FROM MAGNETICALLY CONFINED PLASMAS. David B. Beard (Lockheed Research Lab., Palo Alto, Calif.) and Univ. of California, Davis). Phys. Fluids 2, 379-89(1959) July-Aug.

The cyclotron emission from a hot, completely ionized, magnetically confined plasma has been estimated by computing the absorption of an incident plane wave. The harmonics of the fundamental cyclotron frequency, which are emitted perpendicular to the magnetic field direction, were summed over and also treated individually. Because of the Doppler effect and the relativistic variation in mass the behavior of the electrons and the electromagnetic properties of the medium are functions of electron velocity. Assuming

a Maxwell-Boltzmann distribution in electron velocity, the polarization of the plasma was computed by integrating over electron velocity. Solution of Maxwell's equations yielded the absorption of an incident wave, and thus, from Kirchhoff's relation, the emission of the plasma was determined. The entire calculation was carried out nonrelativistically to first order in v^2/c^2, and at temperatures too low for fluctuations to play a dominant role. (auth)

18339

ON THE BEHAVIOR OF PLASMA AT IONIC RESONANCE. P. H. Doyle and Jacob Neufeld (Oak Ridge National Lab., Tenn.). Phys. Fluids 2, 390-2(1959) July-Aug.

An electromagnetic wave having its wave vector parallel to the direction of the steady magnetic field $\hat{H}$ is attenuated in plasma very effectively when the frequency ω is equal to the ionic resonance frequency Ω_g of the plasma. A small localized periodic disturbance initiated in a plasma in thermodynamic equilibrium at $t = -\infty$ and having frequency $\omega = \Omega_g$ produces along the direction of the magnetic field a wave motion characterized by a complex wave vector. The attenuation per wavelength at the resonance frequency is substantial since $\mathrm{Im}k/\mathrm{Re}k = 1/\sqrt{3}$. However, the attenuation per unit of length is not at maximum at ionic resonance since it increases for increasing frequencies when ω passes through the resonance. (auth)

18340

RAYLEIGH'S PROBLEM IN MAGNETOHYDRODYNAMICS. C. C. Chang and J. T. Yen (Univ. of Minnesota, Minneapolis). Phys. Fluids 2, 393-403 (1959) July-Aug.

Extension of Rayleigh's problem to magnetohydrodynamics is investigated for a perfectly conducting plate with a transversely applied magnetic field. Induced electric and magnetic fields are both included in the analysis. Results obtained show that along the plate an electromagnetic body force will act in the direction of fluid motion. The results are found to be the same whether the applied magnetic field is fixed-in-space or attached to the moving plate. A comparison of these results with those of Rossow (magnetic field fixed with fluid) shows opposite trends in the velocity profile. Such discrepancies are discussed. Rossow's second case (magnetic field fixed with plate) is also discussed. (auth)

18341

LAMINAR STEADY-STATE MAGNETOHYDRODYNAMIC FLOW IN AN ANNULAR CHANNEL. Samuel Globe (AVCO Mfg. Corp., Wilmington, Mass.). Phys. Fluids 2, 404-7(1959) July-Aug.

The problem considered is the steady flow of an electrically conducting, incompressible fluid, in the annular space between two infinitely long cylinders, under a radially impressed magnetic field. The general magnetohydrodynamic equations are simplified by the conditions of the problem to three equations in pressure, velocity, and magnetic field. One equation gives the pressure variation in the radial direction; the other two are coupled equations for the velocity and magnetic field, which are functions of the radial variable only and may be solved for in closed form. In the limiting case where the radii of the annulus become infinite, but their difference remains finite, the solution converges on the expression for magnetohydrodynamic flow between infinite planes under a transverse magnetic field. (auth)

18342

THEORY OF RADIATION FROM LUMINOUS SHOCK WAVES IN NITROGEN. P. Hammerling, J. D. Teare, and B. Kivel (Avco-Everett Research Lab., Everett, Mass.). Phys. Fluids 2, 422-6(1959) July-Aug.

The physical properties behind a normal shock in nitrogen are calculated as a function of time. These include the variation of temperature, composition, ionization, and the intensity of radiation from the N_2^+ first negative band system. This calculation incorporates a rate equation for the dissociation of nitrogen, the conservation laws, an equation describing vibrational relaxation, and a method of coupling the vibrational relaxation with the dissociation rate. The N_2^+ radiation is computed assuming excitation of the radiating state by collision with vibrationally excited nitrogen molecules. A particular case is considered for which experimental data are available, and regions sensitive to particular rates are indicated. (auth)

18343

CONDENSATION OF AN IMPERFECT BOSON GAS. Robert H. Kraichnan (New York Univ.). Phys. Fluids 2, 463-5(1959) July-Aug.

The nature of the Einstein-Bose condensation in an imperfect boson gas is discussed. It is argued that no matter how low the temperature, provided it is not zero, macroscopic second-sound waves should be weakly excited as thermal fluctuations about equilibrium. This implies that the single-particle momentum distribution must be smeared so that the state of zero momentum cannot contain a finite fraction of the particles. A microscopic mechanism which independently leads to a momentum spread is discussed. It is suggested that the actual Einstein-Bose condensation of an imperfect gas takes place in energy rather than momentum but that even in terms of this variable it becomes perfectly sharp only at zero temperature. This hypothesis is formulated analytically in terms of correlation functions of the second-quantized boson field. (auth)

18344

RADIATION-INDUCED CAVITATION. D. Lieberman (Univ. of California, Los Angeles). Phys. Fluids 2, 466-8(1959) July-Aug.

Measurements of the thresholds of radiation-induced acoustic cavitation in pentane and acetone are described. A resonator method was employed. It is concluded that the observed cavitation was nucleated by recoil carbon ions in pentane. The results are compared with calculations based on Seitz's model of the nucleation process. The agreement is within an order of magnitude. (auth)

18345

RESPONSE OF ELECTROSTATIC PROBES TO IONIZED GAS FLOWS IN A SHOCK TUBE. Robert G. Jahn (California Inst. of Tech., Pasadena) and Fred A. Grosse (Lehigh Univ., Bethlehem, Penna.). Phys. Fluids 2, 469-70(1959) July-Aug.

Signals generated in one probe are mirrored in other nearby probes with little loss of amplitude. All such signals will be superimposed on the usual probe response to the charge sheath configurations in their immediate neighborhood. (C.J.G.)

18346

SINGLE-PARTICLE ENERGIES IN A DEGENERATE ELECTRON GAS AT HIGH DENSITY. Ronald M. Rockmore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 941-5(1959) May 15.

Expressions for the self-energy of an electron and the physical pair-propagator for an excited electron

plus hole in a degenerate electron gas at high density are obtained through the formulation of an equivalent Hamiltonian for the problem. These expressions are identical to those obtained by Quinn and Ferrell. A derivation of the physical pair-propagator from ground state considerations is also given. (auth)

18347

DEPENDENCE OF ELECTRON MOBILITY ON MAGNETIC FIELD IN A FULLY IONIZED GAS. M. S. Sodha (Illinois Inst. of Tech., Chicago) and Y. P. Varshni (Univ. of Allahabad, India). Phys. Rev. 114, 946-7(1959) May 15.

The variation of drift and Hall mobilities of electrons in a fully ionized gas with magnetic field was investigated. (auth)

18348

DEUTERON MAGNETIC RESONANCE SPECTRUM AND RELAXATION IN KD_2PO_4. John L. Bjorkstam and Edwin A. Uehling (Univ. of Washington, Seattle). Phys. Rev. 114, 961-8(1959) May 15.

The electric field gradient (EFG) tensor at the site of the deuteron in the hydrogen bond of KD_2PO_4 and the relaxation times of the deuteron have been studied. The measured quadrupole coupling constant is 119 kc/sec, the asymmetry parameter is 0.049, and the major principal axis of the tensor is along the bond direction. None of these features of the EFG tensor change appreciably with temperature over the entire range studied, which range includes the ferroelectric Curie point T_c. An interesting additional splitting in the spectral lines below T_c is observed however. The thermal relaxation time of the deuteron has been studied carefully only at room temperature. One obtains $T_1 = 6.5$ minutes at a particular orientation of the crystal decreasing by a factor of 2 at other particular orientations. T_2 is of the order 5×10^{-4} second. All deuterons have the same relaxation as a function of crystal orientation although falling into distinct categories from the point of view of relative orientation of electric field gradient tensor and applied magnetic field. This interdependence of deuterons in different environments and the possible causes of relaxation are discussed. (auth)

18349

HALL EFFECT, RESISTIVITY, AND MAGNETORESISTIVITY OF Th, U, Zr, Ti, AND Nb. Ted. G. Berlincourt (Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.). Phys. Rev. 114, 969-77(1959) May 15.

The Hall effect, resistivity, and magnetoresistivity of Th, U, Zr, Ti, and Nb have been studied at temperatures between ~ 1°K and room temperature and in magnetic fields up to 30 kilogauss. Strong temperature and purity dependences were observed in the Hall coefficients of U, Ti, and Zr. In addition, the Hall coefficient of Zr was strongly dependent upon magnetic field strength at liquid helium temperatures. Comparisons with theory have been carried out, and it is concluded that existing theories are not sufficiently general to account quantitatively for the observed temperature and magnetic field dependences of the Hall effect and resistivity. Unusual behavior was observed in the magnetic-field-induced superconducting transition of Nb. (auth)

18350

LIFETIMES AND CAPTURE CROSS SECTIONS IN GOLD-DOPED SILICON. W. D. Davis (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 114, 1006-8(1959) May 15.

The free lifetimes of electrons and holes in gold-doped silicon were determined by applying an electric field and measuring the amplitude of the pulses produced by α particles. Knowing the impurity concentrations and assuming that the lifetime is determined primarily by capture at the gold sites, the cross sections for capture were calculated. The value for either electrons or holes at neutral gold sites is 2×10^{-15} cm^2 and at oppositely-charged sites, 1×10^{-13} cm^2. (auth)

18351

CRYSTAL STRUCTURE OF HELIUM ISOTOPES. Jerry Donohue (Univ. of Southern California, Los Angeles). Phys. Rev. 114, 1009(1959) May 15.

The neutron diffraction data of Henshaw for crystalline He^4 have been treated by the method of least squares to obtain revised values of the lattice constants and their standard errors. The values so obtained, together with the pressure-volume-temperature data of Dugdale and Simon, are used to make a direct comparison with the interatomic distances and molar volume for β-He^3, which is also hexagonal close-packed. (auth)

18352

DIFFUSION, DE-EXCITATION, AND THREE-BODY COLLISION COEFFICIENTS FOR EXCITED NEON ATOMS. A. V. Phelps (Westinghouse Research Labs., Pittsburgh). Phys. Rev. 114, 1011-25(1959) May 15.

Diffusion coefficients, de-excitation cross sections, and three-body collision coefficients for neon atoms of the $1s^22s^22p^53s$ configuration are obtained from optical absorption measurements of relative decay rates and relative densities of excited atoms following a pulsed discharge. Atoms in the lower metastable ($^3P_2$) and the lower radiating ($^3P_1$) states are destroyed by diffusion to the wall, three-body collisions involving two ground state atoms, and the escape of imprisoned resonance radiation. The diffusion coefficient at unit neon density and 300°K for the metastable states is 5.5×10^{18} cm^{-1} sec^{-1}. The rate of escape of resonance radiation agrees with the predictions of Holstein's theory. At 300°K the average cross section for collisional de-excitation of $^3P_1$ atoms to the $^3P_2$ state is 5×10^{-19} cm^2 and is about 6×10^{-20} cm^2 for the $^3P_0$ to $^3P_1$ and $^3P_0$ to $^3P_2$ transitions. The cross section for the $^3P_1$ to $^3P_2$ de-excitation increases by an order of magnitude between 200°K and 500°K and is three times larger for de-excitation by helium than by neon at 300°K. The three-body collision coefficient for the $^3P_2$ state is 5×10^{-34} cm^6/sec at 300°K and 5×10^{-35} cm^6/sec at 77°K. Estimates of average cross sections for de-excitation by thermal electrons give 10^{-13} cm^2 for the $^3P_1$ to $^3P_2$ process and 10^{-14} cm^2 for the $^3P_0$ to $^3P_1$ transition. (auth)

18353

SLOW-ELECTRON SCATTERING BY ATOMIC OXYGEN. S. C. Lin and B. Kivel (AVCO Research Lab., Everett, Mass.). Phys. Rev. 114, 1026-7(1959) May 15.

The collision cross section of slow electrons in atomic oxygen has been deduced from simultaneous measurements of the d-c conductivity and the microwave absorption coefficient of a predominantly atomic oxygen gas mixture in a shock tube. The results showed that the Maxwell-averaged cross section attributable to atomic oxygen must be about 1.5×10^{-16} cm^2 at an electron temperature of 4000°K (mean thermal energy ~ 0.5 ev). Elaborating on the theoretical method of Klein and Brueckner, we find that this value is not inconsistent with the photodetachment cross section of negative oxygen ions measured by Branscomb and co-workers. (auth)

18354
FORMULAS OF ALLOWED BETA DECAY. Masato Morita (Columbia Univ., New York). Phys. Rev. 114, 1080-1(1959) May 15.

The corrections due to the relativistic matrix elements are given for the various formulas describing all phenomena of allowed beta decay. It is shown that without explicit calculation one can derive these corrections from the formulas for the first forbidden transitions, which have been published in many papers. It is suggested that a generalization of the present work to the higher forbidden transitions can be made. (auth)

18355
DISPERSION RELATIONS FOR p-n SCATTERING. J. Hamilton (Brookhaven National Lab., Upton, N. Y. and Cornell Univ., Ithaca, N. Y.). Phys. Rev. 114, 1170-8(1959) May 15.

The application of dispersion relations to low-energy p-n scattering is examined. It is shown that Khuri's dispersion relation can be extended to include tensor forces, but serious difficulties appear on attempting to include exchange forces. The application of the relativistic field theory dispersion relations to low-energy scattering is made by using the effective range formula. The spurious poles of the S-matrix are related to the two- and three-pion terms in the unphysical region contribution for forward scattering. (auth)

18356
THEORY OF NEGATIVE-MASS CYCLOTRON RESONANCE. D. C. Mattis and M. J. Stevenson (International Business Machines Corp., Poughkeepsie, N. Y.). Phys. Rev. Letters 3, 18-20(1959) July 1.

It was recently suggested that the re-entrant energy contours of the heavy-hole bands in Ge and Si could contribute a negative resistivity component to the overall resistivity of these materials, possibly related to a non-equilibrium density of carriers in these re-entrant states. Such a phenomenon could be observed under cyclotron resonance conditions as an emission spectrum centered about the cyclotron frequency of these states, or as a reduction in the strength of the background absorption at that frequency. This idea is examined in detail, and it is found that except under very restrictive conditions, these states will in general add a normal, positive resistivity contribution to the material independently of their population. (W.D.M.)

18357
ROLE OF NEGATIVE EFFECTIVE MASS IN NEGATIVE RESISTANCE. Peter Kaus (Univ. of Southern California, Los Angeles). Phys. Rev. Letters 3, 20-3(1959) July 1.

Experiments on cyclotron resonance of negative-mass carriers in Ge have been reported. The distribution of carriers is not an equilibrium distribution, since the carriers were produced by optical excitation partly from acceptors and partly across the gap. A new resonance is found for the opposite sense of circular polarization to the positive-mass resonance line and the resonance corresponds to a decreased absorption. The relationship between negative effective mass, carrier distribution, and negative resistance is investigated. (W.D.M.)

18358
SMEKAL-RAMAN TYPE MODIFIED X-RAY SCATTERING. K. Das Gupta (Ohio State Univ., Columbus, Ohio). Phys. Rev. Letters 3, 38-40(1959) July 1.

With the help of a bent mica Cauchois spectrograph and a bent quartz spectrograph, and using Kα and Kβ radiations of Cu and Mo from the sealed-off x-ray tubes with graphite, polystyrene, and Be as scattering specimens, the modified lines of Smekal-Raman type were observed in calculated positions using the spectrographs for each of the scattering specimens. Tracings of the original microphotometer records are given, clearly showing Rayleigh lines, Compton bands, and Smekal-Raman type modified lines in x-ray scattering. (W.D.M.)

18359
MEASUREMENTS OF THE MELTING CURVE OF PURE He^3 BELOW THE MINIMUM. J. L. Baum, D. F. Brewer, J. G. Daunt, and D. O. Edwards (Ohio State Univ., Columbus). Phys. Rev. Letters 3, 127-8(1959) Aug. 1.

The melting curve of pure He^3 was measured in the temperature range 0.12 to 0.7°K by observing the pressure and temperature of a constant volume containing the liquid and solid phases in equilibrium. The experimental arrangement is described. The results from five runs are presented and compared to other results. (W.D.M.)

18360
MANY-PARTICLE COOPERATIVE SCATTERING OF X-RAYS IN THE TWO-CRYSTAL SPECTROMETER. William E. Dibble (California Inst. of Tech., Pasadena). Phys. Rev. Letters 3, 131-2(1959) Aug. 1.

It has been emphasized previously that low-angle x-ray scattering patterns should theoretically exhibit a relatively high, extremely narrow central maximum because the entire irradiated sample will scatter coherently in the same phase at scattering angles very close to zero. This should be observed in some cases where the x-ray beam has been collimated by means of a plane, nearly perfect crystal. Such a case arises when the two-crystal spectrometer is used in parallel position for the study of low-angle x-ray-diffraction patterns. (W.D.M.)

18361
DETECTION OF COHERENT BREMSSTRAHLUNG FROM CRYSTALS. O. R. Frisch and D. N. Olson (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters 3, 141-2(1959) Aug. 1.

When fast electrons pass through a crystal it is expected that the bremsstrahlung will be enhanced and linearly polarized if the electrons travel in a direction nearly parallel to some densely occupied rows of atoms. Using a small germanium crystal, the expected enhancement was found. The crystal was mounted in the Cornell synchrotron in such a way that the 1-Bev electrons would cut across one of its edtes, approximately in the direction on which there is a nucleus every 4.0 A. (W.D.M.)

18362
A SURVEY OF OUR PRESENT SOURCES OF INFORMATION ON THE CONVERSION CONSTANT, $\Lambda(=\lambda_g/\lambda_s)$ AND THE ABSOLUTE WAVELENGTHS OF X-RAY EMISSION LINES. Jesse W. M. DuMond (California Inst. of Tech., Pasadena). Proc. Natl. Acad. Sci. U. S. 45, 1052-80(1959) July.

The conversion constant, $\Lambda = \lambda_g/\lambda_s$, is not at present known with sufficient precision to permit tabulating the standard x-ray emission line wavelengths in milliangstrom units without a serious sacrifice of the precision with which these wavelengths are now known relative to each other. The unit in which x-ray wavelengths, using crystal diffraction methods, can be measured with highest accuracy should be redefined by tying it to one or more standard x-ray emission lines

and abandoning its present conventional definition in terms of purest or perfect calcite. Great care and circumspection should be used in defining the fiducial reference point on the natural profile of an x ray line which shall be taken as the wavelength. The tabulated wavelengths at present in general usually correspond most nearly to the peak because of the methods used in their determination. The centroid of the profile does not necessarily coincide with the peak by any means and while it possesses certain attractive mathematical properties the difficulties of establishing its relationship to the tabulated peak values in a reliable way are considerable and as yet not in most cases surmounted. (auth)

18363

THE ULTRA-VIOLET SPECTRA OF HF AND DF. J. W. C. Johns and R. F. Barrow (Oxford Univ.). Proc. Roy. Soc. (London), A251, 504-18(1959) June 23.

Successful analyses have been made of the ultraviolet spectra excited by electric discharges in mixtures of helium with HF or DF. The spectra, which consist of large numbers of irregularly spaced lines, are shown to arise from transitions $V^1\Sigma^+ - X^1\Sigma^+$ in neutral HF and DF. State X is the ground state: state V, the lowest stable excited singlet state, probably correlates with $H^+ + F^-$. The potential minimum of state V lies at 10.5 ev above that of the ground state. The internuclear distance in this state—in agreement with theoretical predictions—is large, more than twice that in the ground state, so that the bands observed consist of transitions from low vibrational levels in V to high vibrational levels in X. In HF, the observed levels are $9 \leq v'' \leq 19$: predissociation by rotation is observed in the levels $10 \leq v'' \leq 19$. The last vibrational state which may have a few stable rotational levels is $v'' = 20$, so that, by combining the present observations with those of the vibration-rotation bands, there is now available information about the vibrational and rotational levels over the greater part of their range of stable existence in the ground state. The dissociation energy, D_0'', of HF is found to be 5.86 ± 0.01 ev. (auth)

18364

STRUCTURE OF SPECTRAL LINES FROM PLASMAS. Henry Margenau and Marvin Lewis (Yale Univ., New Haven). Revs. Modern Phys. 31, 569-615(1959) July.

Plasma line broadening is discussed with attention restricted to emission. The statistical theory and the impact theory are applied and discussed as to limits of each and circumstances under which each is best applied. Adiabaticity, perturber interactions, and treatment for radiating ions are expressed in mathematical formulas. The wing theorem and quantum theory are applied to achieve numerical estimates for the Balmer lines, including those with high quantum numbers. Broadening by electrons only is discussed relative to adiabatic theory and Lyman lines. Basic formulas for simultaneous broadening by ions and electrons in adiabatic approximation are presented. Plasma properties are discussed in relation to experimental determinations. (C.J.G.)

18365

ELECTRONIC BAND STRUCTURE OF SOLIDS BY X-RAY SPECTROSCOPY. L. G. Parratt (Cornell Univ., Ithaca, N. Y.). Revs. Modern Phys. 31, 616-45(1959) July.

Advantages and disadvantages of x-ray spectroscopy are enumerated. The two energy regions of the method are discussed in reference to differences, resolving power, corrections, and diagrams. Discussions of the extended structures and discrete loss of energy of electrons are presented. Emission bands for sodium, magnesium, aluminum, nickel, copper, and zinc are discussed. (C.J.G.)

18366

A STUDY OF THE IMPERFECTION STRUCTURE OF METALLIC SINGLE CRYSTALS BY NEUTRON DIFFRACTION. B. G. Liashchenko, D. F. Litvin, I. M. Puzei, Iu. G. Abov, and V. S. Golovkin. Soviet Phys.—Cryst. 3, 147-52(1958) Mar.-Apr.

A neutron diffraction investigation is made of the imperfection structure of nickel alloys, and the effect of such a structure on the nature and intensity of diffraction reflections associated with neutron scattering is shown. The results are prefaced by a résumé of work done in the neutron diffraction investigation of the structure of artificial single crystals. (auth)

18367

SELF-CONSISTENT FOCK'S FIELD IN TERNARY CONFIGURATION APPROXIMATION FOR NEGATIVE LITHIUM ION. T. D. Strockyte and A. Jucys. Trudy Akad. Nauk Litovskoĭ S.S.R., Ser. B No. 1(13), 11-19 (1958). (In Russian)

Solutions are given for the standard Fock's equations for the basic Li^- configuration and for the binary configuration approximation of Fock's equation for radial wave functions 2p in the corrective binary configuration approximations $1s^22s^2 - 1s^22p^2$ and $1s^22s^2 - 2s^22p^2$. The total energy in the ternary configuration approximation $1s^22s^2 - 1s^22p^2 - 2s^22p^2$ was determined using the radial wave functions. Results determining the electronic relation of the lithium atom show that the self-consistent Fock's field in an approximation of a single configuration does not confirm the stability of Li^- (electron relation is 0.005 at. units), while an expansion of the method to multiconfiguration approximation indicates the electron relation is +0.020 at. units. (tr-auth)

18368

ON THE MULTICONFIGURATION APPROXIMATION AND ITS FURTHER DEVELOPMENT. A. P. Jucys, J. Vizbaraite, J. Batarunas, and V. Kaveckis. Trudy Akad. Nauk Litovskoĭ S.S.R., Ser. B No. 2(14), 3-14 (1958). (In Russian)

The development of the multiconfiguration approximation is described. Corrections of the approximation are carried out with the aid of a dielectron state model. The corrected multiconfiguration approximation is adapted to the ground and first excitation configurations of the lithium-type atoms (Li, Be^+, and Be^{2+}) and to the ground configuration of beryllium-type atoms (Li^-, Be, and Be^+). The results of multiconfiguration approximations used on the basis of a dielectric state model are discussed. (tr-auth)

18369

SELF-CONSISTENT FOCK FIELD IN MULTICONFIGURATION APPROXIMATION FOR NEGATIVE SODIUM ION. T. D. Strockyte and A. Jucys. Trudy Akad. Nauk Litovskoĭ S.S.R., Ser. B No. 2(14), 17-23(1958). (In Russian)

Solutions were derived for Fock's equations in multiconfiguration approximations for radial wave functions 3p and 3d, and corrections of binary configuration approximations $3s^2 - 3p^2$ and $3s^2 - 3d^2$ for the Na^- ion. The derived functions are used for determining the energy of the $3s^2$ shell in ternary configuration approximation

$3s^2-3p^2-3d^2$. The magnitudes of sodium atomic electron relations are included. (tr-auth)

18370

ON MAGNETOHYDRODYNAMICAL EQUATIONS. R. V. Polovin and N. L. Tsintsadze (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 30-8(1959) Jan.-Feb. (In Ukrainian)

It is proved that magnetohydrodynamical equations may be obtained from the equations of motion of electrons and ions in the limiting cases of low frequencies when the free path is considerably less than the characteristic lengths (frequent collisions) and when the free path is considerably greater and the ion Larmor circle radius is considerably less than the characteristic lengths (rare collisions). It is shown that if collisions are rare, there exist equations of state, provided that the motion of charged particles along the magnetic field lines is finite. The phase velocities of small amplitude fluctuations are found. It is proved that the plasma is unstable relative to small amplitude oscillations if the anisotropy of pressure is sufficiently large. (auth)

18371

SURFACE IONIZATION. E. Ya. Zandberg and N. I. Ionov. Uspekhi Fiz. Nauk 67, 581-623(1959) Apr. (In Russian)

An analytical review is presented of data on various phases of surface ionization. 113 references. (R.V.J.)

18372

HIGH STRENGTH FINE CRYSTALS. E. M. Nadgornyi, Yu. A. Osip'yan, M. D. Perkas, and V. M. Rozenberg. Uspekhi Fiz. Nauk 67, 625-62(1959) Apr. (In Russian)

The basic methods of preparing and testing so-called "whisker" crystals are reviewed. The mechanisms of crystal growth and their mechanical and physical properties are analyzed. 81 references. (R.V.J.)

18373

STRESSES IN CONTOURED OPENINGS OF PRESSURE VESSELS. Donald E. Hardenbergh (Pennsylvania State Univ., University Park). Welding Research Council Bull. Ser. No. 51, 13-25(1959) June.

The introduction of a branch line into a pressure vessel or pipeline creates a region of increased localized stress in the vicinity of the branch connection. The purpose of this investigation is to provide experimental data which show the general state of stress at branch connections, and to determine the extent of stress intensification in that region. A study made on four hot-formed contour branch connections is reported. They represent a combination of two different shapes of openings and two thicknesses of branch pipes. The type of loading that was applied was internal pressure. (auth)

18374

A THREE-DIMENSIONAL PHOTOELASTIC STUDY OF STRESSES AROUND REINFORCED OUTLETS IN PRESSURE VESSELS. C. E. Taylor, N. C. Lind, and J. W. Schweiker (Univ. of Illinois, Urbana). Welding Research Council Bull. Ser. No. 51, 26-41(1959) June.

The three-dimensional photoelastic determination of the stresses around cylindrical outlets in spherical and cylindrical shells loaded by internal pressure is described. Several sizes and shapes of reinforcement were tested to study the effects of certain variables and to determine an optimum design. The results are tabulated in the form of stress-concentration factors. Distribution of the principal stresses on the surfaces of the models are included. (auth)

18375

THEORY OF ELEMENTARY PARTICLES. H.-P. Dürr, W. Heisenberg, H. Mitter, S. Schlieder, and K. Yamazaki (Max-Planck-Institut für Physik und Astrophysik, Munich). Z. Naturforsch. 14a, 441-85(1959) May-June. (In German)

The equation $\gamma_\nu(\partial/\partial x_\nu)\,\psi \pm l^2\gamma_\mu\gamma_5\psi(\bar{\psi}\,\gamma_\mu\gamma_5\,\psi) = 0$ is analyzed with respect to the following consequences. In I the group theoretical structure of the equation is studied. The equation is invariant under a number of continuous transformations: the inhomogeneous Lorentzgroup, the transformations of Pauli, Gürsey, and Touschek, and the scale transformation [$x \to \eta x$ or $\psi \to \eta^{3/2}\psi(x\eta, l\eta)$]. The Pauli-Gürsey group is used for the interpretation of the isospin; the γ_5-transformation of Touschek establishes a quantum number I_N, and the scale transformation leads to a quantum number l_N, which both are connected with the baryonic and the leptonic number. The strangeness $s = l_N - l_Q$ is suggested to be connected with the discrete groups of the equation and could then be defined and conserved only modulo 4. Of the discrete groups only the well known transformations P, C, and T and the reversal of $l(l \to -l)$ are briefly discussed. In II the vacuum expectation values of products of two field operators are studied. These values are considered to be only in a first approximation invariant under the isospin group. The deviations from the Pauli-Gürsey symmetry in higher approximations are supposed to be due to the replacement of the state "vacuum" by an idealized "world," which possesses an infinite isospin; the strange particles are consequently interpreted as states which "borrow" an isospin $\frac{1}{2}$ or 1 from the ground state "world." The concept of "One particle-wavefunctions" is discussed in III. The fermions of finite mass belong to wavefunctions obeying a Klein-Gordon-spinor equation instead of a Dirac equation. The connection with the conventional formalism of the Dirac equation is treated in detail. The process of conjugation springing from these discussions is used for a variation of the methods of approximation needed later on for the determination of mass values and the pion-nucleon coupling constant. In IV the Tamm-Dancoff method is applied in two different forms for an estimate of the masses of nucleons and π mesons. The masses and the symmetry properties of the particles agree qualitatively with the experimental results. The scattering of π mesons from nucleons is treated in V by a method related more closely to the Bethe-Salpeter theory than to the Tamm-Dancoff method; the theory leads to a relativistic pseudovector-coupling as the main term and to a value of the coupling constant of the right order of magnitude. In VI the interaction for β decay is analyzed with respect to its symmetry properties. The theory leads to $c_s = c_T = c_p = 0$ and, in the lowest approximation, to $c_A = -c_V$, while in higher approximations, the ratio c_A/c_V will be somewhat altered. In VII some mathematical questions are discussed that have been raised by Pauli at the Geneva conference 1958. For the renormalized operators of the Lee model an integro-differential equation is given, that contains only the arbitrarily small time interval Δt. It is further shown in detail why a linear differential equation leads to δ-functions on the light cone for the propagator, while a non linear differential equation can produce there a different kind of singularity. (auth)

18376

THE DEFINITION OF ELECTRON DIFFRACTION BY

MEANS OF A SCATTERING MATRIX AND ITS PRACTICAL APPLICABILITY. H. Niehrs (Max-Planck-Gesellschaft, Berlin). Z. Naturforsch. 14a, 504-11(1959) May-June. (In German)

Matrix operators for electron diffraction by irradiated crystals (Laue yield) and the accompanying processes (reflection) can be derived from dynamic diffraction theory. The change in amplitude variation is described with respect to the radiation direction, and an explicit expression for the radiation intensity transmitted and reflected even in the polychromatic yield is permitted without the necessity of a determination of the wave field in the crystal (solution of an eigenvalue problem). The scattering matrix process is almost always superior to the general eigenvalue process, due to the fact that the computation requirement for its use is considerably less. (tr-auth)

18377

NON-LINEAR WAVE EQUATION FOR SPINOR MODEL IN QUANTUM THEORY. K. Ladányi (Ungarischen Akademie der Wissenschaften, Budapest). Z. Naturforsch. 14a, 580-1(1959) May-June. (In German)

From a few simple hypotheses a qualitative model of the theory of elementary particles is constructed based on a Lagrange function. These hypotheses are: (1) the non-linear part of the Lagrange function corresponds to a universal Fermi interaction, (2) the Lagrange function shows no invariance character which is not found in nature, (3) only two spinors with four components Ψ_1 and Ψ_2 enter into the theory, and (4) the Lagrange function is invariant compared with the transformations $\Psi_2' = e^{i\beta}\Psi_2$ and $\Psi_1' = e^{i\alpha}\Psi_1$. (T.R.H.)

18378

SPECTROSCOPIC INVESTIGATION OF POWERFUL PULSED DISCHARGES IN HYDROGEN. III. DETERMINATION OF THE PARAMETERS OF A HIGH TEMPERATURE PLASMA. S. Yu. Luk'yanov and V. I. Sinitsin. Zhur. Eksptl'. i Teoret. Fiz. 36, 1621-24 (1959) June. (In Russian)

Results of spectroscopic measurement of the parameters of a high-temperature plasma are presented. It is shown that at the moment of maximum constriction the density of the charged particles at the axis of the discharge is 35 to 40 times greater than the initial density of the neutral atoms. The ion temperature in this case attains a value of 1 to 2 million degrees. (auth)

18379

SLIPPING AND TEMPERATURE DISCONTINUITY AT THE BOUNDARY OF A GAS MIXTURE. R. Ya. Kucherov and L. E. Rikenglaz. Zhur. Eksptl'. i Teoret. Fiz. 36, 1758-61(1959) June. (In Russian)

Boundary conditions were obtained for the hydrodynamical transfer equations for a gas mixture. The conditions take into account slipping and the temperature jump at the boundary with a solid surface. (auth)

18380

ON THE RADIATION FORCE IN THE MOTION OF A CHARGE IN A MEDIUM. V. L. Ginzburg and V. Ya. Eidman (Gorki State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1823-33(1959) June. (In Russian)

The radiative force is computed for a charge moving in a medium which, in the general case, is considered to be anisotropic and gyrotropic. The radiative force in a medium can play a significant role when the particle moves in a magnetoactive plasma, in channels and slits in dielectrics and also in wave guides. At velocities larger than the phase velocity of light in the medium the radiative force which changes the amplitude of the oscillations and which is related to the emission of anomalous Doppler frequencies, possesses a different sign than that of radiative friction due to the emission of normal Doppler frequencies. The total radiative force which is responsible for the change in the amplitude of the oscillations of a particle in an isotropic medium corresponds to friction also in the case of super-light motion. However this friction may be appreciably smaller than the radiative friction encountered at sub-light velocities. In an anisotropic medium amplification of the oscillations may occur instead of friction. The decrease of the radiative friction or the appearance of the amplification may be related to the peculiarities of the anomalous Doppler effect as revealed by a quantum mechanics analysis and also to the unstability of the super-light particle beams. (auth)

18381

ON THE MOTION OF A PLASMA LOOP IN AXIALLY SYMMETRICAL MAGNETIC FIELDS. L. M. Kovrizhnykh (P. N. Lebedev Physics Inst., Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1834-8(1959) June. (In Russian)

Some problems related to the dynamics of a plasma loop located in an inhomogeneous axially symmetrical magnetic field are considered. (auth)

18382

ON TRANSITION RADIATION AND THE VAVILOV-CHERENKOV RADIATION. V. E. Pafomov (P. N. Lebedev Physics Inst., Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. Teoret. Fiz. 36, 1853-8(1959) June. (In Russian)

The angular distribution of the radiation emitted by a charged particle passing through the boundary between vacuum and an isotropic ferrodielectric and between vacuum and a dielectric crystal is considered. It is shown that the radiation significantly depends on the sign of the group velocity. Transition radiation is considered in connection with those peculiarities of the Vavilov-Cherenkov radiation which occur in crystals and also in isotropic media in the frequency range with a negative group velocity. The "reversed" Doppler effect is considered. (auth)

18383

ACCELERATION OF PLASMA CLUSTERS BY HIGH FREQUENCY ELECTROMAGNETIC FIELDS. M. A. Miller (Gorki State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1909-17(1959) June. (In Russian)

It is shown that it should be possible to accelerate clusters of a completely ionized quasineutral plasma located in a moving high frequency potential well. If the well is formed by the fields of two waves of different frequency, it can be accelerated only by changing the frequency of one of the waves or by employing wave guides of varying cross section. Some peculiarities of linear and cyclic plasma accelerators are considered. (auth)

18384

THE OVERHOUSER EFFECT IN FORBIDDEN RESONANCE SATURATION. L. L. Buishvili (Tbilis State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1926-7(1959) June. (In Russian)

A system consisting of an electron shell with an effective spin S, equal to $\frac{1}{2}$, and a nucleus with spin I, placed in an external magnetic field H, was studied in order to determine the steady Overhouser effect in the case of paramagnetic resonance forbidden transition saturation. Considering the external field sufficiently

strong, the spin-spin interactions and Zeeman nucleus energy are neglected. In the suggested approximation are 2I + 1 level pairs; the difference in component energies for each pair was equal to $g\beta H$. The distribution scheme is shown. (R.V.J.)

18385

ON THE LARMOR PLASMA THEORY. S. A. Kaplan (L'vov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1927-8(1959) June. (In Russian)

A system of effective particles is introduced for the simplification of plasma (not classical) theory. The Larmor particles are distributed along the center of motion of the real particles with magnetic moment $\mu = mv_\perp^2/2H$ (where m is the particle mass, $mv_\perp$ is the component of velocity perpendicular to the magnetic field H) and energy equal to the real particle total energy. All calculations of the Larmor theory are simple and less cumbersome than the kinetic theory. However, the postulated method is complicated by difficulties in determining the Larmor mean life time τ. (R.V.J.)

18386

DYNAMIC PRINCIPLE FOR EQUATION OF SECOND ORDER. A. A. Borgardt (Drepropetrovski State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1928-9(1959) June. (In Russian)

It is shown that the application of the Schwinger dynamic principle to systems with second-order Lagrangians results in identical commutation rules for fermion and boson fields. The same result holds for fields with higher derivatives: the Lagrangians of odd order lead to spinor anticommutation and Lagrangians of even order require commutation. The derived equations can be easily generalized for the calculations of charged fields. (R.V.J.)

18387

CHERENKOV RADIATION OF THE MAGNETIC DIPOLE IN ANISOTROPIC MEDIUM. G. A. Begiashvili and E. V. Gedalin (Tiflis State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1939-40(1959) June. (In Russian)

The Cherenkov radiation of a point magnetic dipole was studied in anisotropic and gyrotropic media. (R.V.J.)

18388

ON THE DYNAMIC MODEL IN THE BROWNIAN THEORY OF MOTION. V. B. Magalinskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1942-4(1959) June. (In Russian)

A simple derivation of certain generalized relations in the Brownian theory of motion was developed on the basis of a dynamic model described by M. Toda (J. Phys. Soc. Japan 13, 1266, 1958). (R.V.J.)

18389

POLARIZATION OF NUCLEI OF WEAKLY MAGNETIC ELEMENTS INCORPORATED IN FERROMAGNETICS. B. N. Samoilov, V. V. Sklyarevskii, and E. P. Stepanov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1944-6(1959) June. (In Russian)

Data are presented on the polarization of Sb^{122} and In^{114m} nuclei in iron. Specimens of Sb (0.6 wt.%) irradiated by thermal neutrons in a reactor and In–Fe (0.5% In wt. %) alloyed after irradiation were used. Results of measurements made of the γ radiation anisotropy at 566 kev (transition $2^+ \rightarrow 0^+$) emitted after Sb^{122} β decay (transition $2^- \rightarrow 2^+$) and γ radiation anisotropy of In^{114m} at 192 kev (transition $5^+ \rightarrow 1^+$) are plotted. An attempt was also made to find the Cr^{51} polarization in Cr–Fe alloy. Measurements of γ anisotropy at 320 kev (transition $5/2^- \rightarrow 7/2^-$) emitted after Cr^{51} K capture (transition $7/2^- \rightarrow 5/2^-$) at 0.03 to 1°K produced negative results. Results showed that the polarization of nuclei of weakly magnetic atoms by incorporation in ferromagnetic is of universal character. (R.V.J.)

18390

PIEZOMAGNETISM IN ANTIFERROMAGNETIC COBALT AND MANGANESE FLUORIDES. A. S. Borovik-Romanov (Inst. of Problems in Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1954-5(1959) June. (In Russian)

A specially designed magnetic balance in which a specimen placed in a press was suspended on vertical expansion springs was used in experiments for determining piezomagnetism in cobalt and manganese fluorides. The control of the press was achieved with an evacuated and sealed siphon. With a 1 mm^2 specimen the magnitude of maximum compression was ~ 500 kg/cm^2. The dependence of the molar magnetic moment on the magnitude of the applied field without compression and with ~ 500 kg/cm^2 pressure was plotted for monocrystals of CoF_2. The measurements were carried out in liquid hydrogen at 20.4°K. The order of relative error was ~ ± 0.3%; absolute error is up to 10%. The piezomagnetic effect was also observed in MnF_2; however, the magnitude was about 100 times smaller than in CoF_2. (R.V.J.)

18391

CALCULATION OF THE HELIUM LIQUEFACTION CYCLE WITH CASCADE ENGAGING OF THE ENGINES. P. L. Kapitsa (Inst. of Problems in Physics, Academy of Sciences, Moscow). Zhur. Tekh. Fiz. 29, 427-32(1959) Apr. (In Russian)

Problems of efficient cascade engagement are discussed. General equations are derived for determining the most effective performance temperatures. It is shown that engines with identical efficiency perform best when an equal amount of gas is supplied to each. An expression is developed for determining the optimum number of engines in a cycle, and an analysis is made of the helium cascade cycle at room temperature and the helium liquefaction cycle. (tr-auth)

18392

ON THE REFLECTION OF AN ELECTROMAGNETIC WAVE FROM THE PLASMA MOVING THROUGH A DIELECTRIC IN A CONSTANT MAGNETIC FIELD. Ya. B. Fainberg and V. S. Tkalich (Khar'kov Inst. of Physics and Tech.). Zhur. Tekh. Fiz. 29, 491-6 (1959) Apr. (In Russian)

The reflection of plane monochromatic waves from an electron plasma moving in dielectric media at the rate of $\beta = (u/c)$ with dielectric constant ϵ and magnetic penetrability $\mu = 1$ is studied. The above assumption is permissible for radiofrequency. The external constant uniform magnetic field with intensity H_0 is directed parallel to the motion of the plasma. The plane perpendicular to the motion acts as the boundary divider. (R.V.J.)

18393

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 14. NUCLEAR PHYSICS AND INSTRUMENTATION. Geneva, United Nations, 1958. 497p. $17.00.

Papers from sessions A-18 and A-19 on nuclear

physics and instrumentation are presented. There are contributions, both experimental and theoretical, in which attempts are made to interpret the behavior of a nucleus. Many developments in nuclear instrumentation and techniques are discussed. (W.D.M.)

18394
LECTURES IN APPLIED MATHEMATICS. VOLUME I. PROBABILITY AND RELATED TOPICS IN PHYSICAL SCIENCES. Mark Kac. London, Interscience Publishers, Ltd., 1959. 277p.

The volume is divided into four chapters. The first (Nature of Probabilistic Reasoning) serves mainly to illustrate how probabilistic notions are introduced and usefully employed in the treatment of a variety of problems. The second (Some Tools and Techniques of Probability Theory) is primarily designed to show how a problem is attacked and solved. The third is Probability in Some Problems of Classical Statistical Mechanics. Chapter four is devoted to problems of classical analysis and physics. (W.L.H.)

18395
IMPROVEMENTS RELATING TO THE PREPARATION OF MOULDS FOR CASTING RESINS. Charles Norman William Reece (to Ferranti, Ltd.). British Patent 814,720. June 10, 1959.

In the casting of resins a mold material is needed which retains its shape up to 150°C. Polyethylene which softens at 80 to 90°C can be used if it is irradiated by x rays, gamma rays, or nuclear particles to raise its softening point to 150°C and above. Only the polyethylene surface to be exposed to the resin need be irradiated. Polyethylene offers the added advantage of not being wetted by the resins, making it easier to release the casting from the mold. (T.R.H.)

Elementary Particles

18396 AFOSR-TR-59-54
Dublin Inst. for Advanced Studies. School of Cosmic Physics.
RATE OF EXTENSIVE SHOWERS OF HIGH ELECTRON DENSITY AT SEA LEVEL. Technical Final Report covering Period from December 1, 1956 through November 30, 1958. 17p. Contract AF61(514)-1164. (AD-216623).

An experimental study was made of the variations in the rates of local penetrating showers of cosmic radiation with solar time, of dense extensive air showers with solar time, and of penetrating extensive showers with sidereal time. The variation in rate of local penetrating showers with solar time was confirmed by measurements made in Dublin, and the results are in reasonable agreement with the theory of Bassi and Ferrari. The study of variation in rate of dense extensive air showers with solar time shows that the size of the showers producing this effect is between 10^6 and 10^7 particles at sea level. The hypothesis that the immediate cause is a change in the structure of the showers at sea level is suggested. The variation with sidereal time was confirmed, but greater statistical accuracy is needed for satisfactory analysis. The performance of arrays for detecting air shower direction was analyzed theoretically, and one array was tested experimentally. (J.S.R.)

18397 NP-7723
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems.
REACTION $p + p \rightarrow d + \pi^+$. L. M. Soroko. 1959. 7p.

Polarization experiments on the reaction $p + p \rightarrow d + \pi^+$ using a longitudinally polarized proton beam are reported. Polarization effects in the reaction are discussed with respect to previously reported results obtained with unpolarized and transverse-polarized beams. (D.E.B.)

18398 NP-7739
Illinois. Univ., Urbana.
EVALUATION OF K^-–NUCLEON SCATTERING PHASE SHIFTS ON BASIS OF PRESENT DATA. Technical Report No. 7. R. D. Hill. Mar. 1959. 12p. Contract Nonr-1834(05).

An estimate of the K^-–neutron elastic scattering cross section was obtained. This is useful in planning a possible emulsion K^-–nuclear scattering analysis. Since the summer of 1958, when Dalitz carried out his evaluation of the phase shifts, certain more complete experimental data, such as the inelastic K^-–proton scattering cross sections as a function of energy and the charge-exchange K^-–proton scattering cross sections, have become available. A re-evaluation of the phase-shifts was therefore felt to be worth-while. (auth)

18399 NP-7776
Washington Univ., St. Louis.
A CLOUD CHAMBER STUDY OF THE UNSTABLE PARTICLES PRODUCED IN NUCLEAR INTERACTIONS OF THE COSMIC RADIATION AT MOUNTAIN ALTITUDE (thesis). Technical Report No. 3. Medford Sherman Webster. July 1959. 165p. Contract NONR-816.

About 10,000 cloud chamber photographs obtained at 11,200 ft above sea level were searched for anomalous events. The experimental setup is described. A number of examples of the established decay modes of the known strange particles were found in the analysis of the pictures. The experiment was designed as a general exploration of the unstable particles produced in interactions of cosmic rays in a block of lead immediately above the cloud chambers and a study of the applicability of drop-counting in a cloud chamber to the measurement of the ionization along the track of the particle. (W.D.M.)

18400 NP-7791
Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.
ON THE IDENTIFICATION OF PARTICLES IN HIGH ENERGY STARS. G. I. Kopylov. 1959. 10p.

A formula is derived which permits diminution of the spacing between limiting values for the momentum of the identified particle in a star. The equation contains masses of other particles, the lower bounds of their momenta, and the angles between the prongs. (auth)

18401 UCRL-8759
California. Univ., Berkeley. Lawrence Radiation Lab.
K^--DEUTERON INTERACTIONS IN FLIGHT (thesis). Paul G. White, Jr. May 15, 1959. 23p. Contract W-7405-eng-48. $0.75 (OTS).

Submitted to the United States Naval Postgraduate School, Monterey, Calif.

Forty-two in-flight K^--deuteron reactions leading to the final-state Λ^0, π^-, and proton are investigated. It is shown that fewer of these reactions involved Σ hyperons in an intermediate state than was the case for kaons interacting at rest. Angular distributions in the K-d and π^--Λ^0 cm systems indicate P-wave as well as S-wave contribution to the reaction $K^- + n \rightarrow \Lambda^0 + \pi^-$. Cross sections are calculated for Λ^0's produced directly (30 ± 6.5 mb) and those produced via the intermediate Σ state (14.5 ± 4.5 mb). (auth)

18402 CEA-tr-R-685
TABLE SUPPORT DE MICROSCOPE POUR LES MESURES DE LA DISPERSION DES PARTICULES DANS LES PHOTOEMULSIONS NUCLÉAIRES. (Microscopic Support Table for the Measurements of the Dispersion of Particles in Nuclear Emulsions.) A. O. Weissenberg, V. A. Smirnistskii (Smirnistsky), and N. V. Rain (Raine). Translated into French from Pribory i Tekh. Ekspt., No. 2, 112-14(1957). 9p.

A description is given of the construction of a support table with glass guides for measurement of the dispersion of particles in nuclear emulsions. The table has a "background" lower than 0.01 μ in the presence of particles up to 500 μ. (tr-auth)

18403 NP-tr-248
NUCLEON INTERACTION CROSS SECTION AT 9 BEV. V. S. Barashenkov and Chuan Nyan-nin (Huang Nyan-ning). Translated from Zhur. Eksptl'. i Teoret. Fiz. 36, 1319-21(1959). 4p. $1.80(ph), $1.80(mf) JCL or LC.

The total effective cross section for N-N interactions at 9 Bev has been reported as 40 mb. It is shown that by using the mean proton range in emulsions, a more exact value may be obtained. The calculated mean free range of 9-Bev protons in NIKFI-P emulsion was plotted and yielded a cross section value of 30 mb. (D.E.B.)

18404
CONTRIBUTION TO THE COVARIANT STUDY OF NUCLEON-NUCLEON SCATTERING AT HIGH ENERGY. Michel Gourdin. Ann. phys. 4, 595-641 (1959) May-June. (In French)

Nucleon-nucleon scattering is studied by means of the Bethe-Salpeter equation. The physical principle is the generalization of the method of partial waves to a scattering problem in four dimensions treated in a covariant manner. To present the method of calculation, the case of particles without spin in scalar interaction with scalar π mesons is considered. Two methods of approximation are given for the solution of the system of coupled integral equations obtained. The treatment is applied to a study of fermions in pseudoscalar interaction with pseudoscalar mesons. (J.S.R.)

18405
EXPERIMENTAL STUDIES OF CHARGED PARTICLE BEHAVIOR IN ADIABATIC TRAP. S. N. Rodionov. Atomnaya Energ. 6, 623-9(1959) June. (In Russian)

The motion of tritium β particles in an adiabatic trap was investigated. It is shown that under certain conditions the number of β-particle reflections from strong magnetic fields (magnetic plug) is over 10^7. The dependence of β-particle lifetime in the trap on gas pressure, magnetic field configuration, and degree of field uniformity is determined. (tr-auth)

18406
HIGH ENERGY PHYSICS. (A REVIEW OF REPORTS PRESENTED AT THE VIII INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS.) L. I. Lapidus and L. B. Okun. Atomnaya Energ. 6, 648-56(1959) June. (In Russian)

A short review is given of research carried out on high-energy interactions of mesons, nucleons, and strange particles and on weak interactions. The achievements in weak interaction physics are stressed. Also, recent achievements in elementary particle physics are discussed. (tr-auth)

18407
THE FREE ENERGY OF SYSTEMS OF CHARGED PARTICLES. I. R. Yukhonovskii (Ivan Franko L'vov State Univ.). Doklady Akad. Nauk S.S.S.R. 126, 557-60(1959) May 21. (In Russian)

A reduced Coulomb potential of $(1-e^{-\alpha r})/r$ type was introduced previously in order to avoid divergence of correlation terms at zero for various ion systems. It is shown that such reduction is superfluous for ionic systems. The normalized expression for the free energy is convergent and is the reference point in calculations of thermodynamic magnitudes and distribution functions. (R.V.J.)

18408
DETERMINATION OF CHARGED PARTICLE MASS BY SCATTERING AND RESIDUAL TRACK IN WILSON CHAMBER. F. R. Arutyunyan, M. I. Daion, and A. A. Ter-Saakyan (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Invest. Akad. Nauk Armyan. S.S.R., Ser. Fiz. Mat. Nauk 11, No. 2, 71-7(1958). (In Russian)

A method for determining charged particle mass by scattering and residual track, used in multiplate Wilson chambers, was verified by applying proton and meson masses previously determined by other methods. (R.V.J.)

18409
DETECTION OF FAST DEUTERONS IN MAGNETIC SPECTROMETER WITH DOUBLE WILSON CHAMBERS. G. V. Badalyan (Inst. of Physics, Academy of Sciences, Armenian S.S.R.). Izvest. Akad. Nauk Armyan. S.S.R., Ser. Fiz. Mat. Nauk 11, No. 4, 29-38(1958). (In Russian)

Descriptions are given of a magnetic spectrometer with two large rectangular Wilson chambers used for recording with track ranges of 1.2 to 5.4 cm. It is shown that the instrument is efficient for recording fast deuterons; moreover, the upper chamber permits the separation of incoming and generated deuterons. The recording of the cosmic deuterons indicates that along with other products a considerable number of energetic deuterons are produced by nuclear interactions with nucleons in the atmosphere. The latter were recorded, and the results are in good agreement with published data. (R.V.J.)

18410
ON THE UNIVERSAL FERMI INTERACTION. W. Królikowski (Univ. of Warsaw and Polish Academy of Sciences, Warsaw). Nuclear Phys. 11, 687-90(1959) June (2).

A formalism proposed previously for elementary particles enables one to express the universal Fermi interaction between fermions in a concise form. (auth)

18411
ON NON-LEPTONIC DECAYS OF HYPERONS. B. D'Espagnat and J. Prentki (CERN, Geneva). Nuclear Phys. 11, 700-5(1959) June (2).

Some numerical estimates are made of various parameters entering in Σ and Λ decays. These are based on the assumptions of an earlier paper, which, using the global symmetry formalism, lead to a general Hamiltonian for weak interactions relating non-leptonic decays of hyperons between each other. (auth)

18412
THE PROPER FIELD OF A PHYSICAL NUCLEON Ning Hu (Joint Inst. of Nuclear Research, Dubna). Nuclear Phys. 12, 87-102(1959) June (3).

The energy values of Tomonaga's intermediate coupling equation for a physical nucleon are obtained from the asymptotic solutions of the equation when the number of mesons is very large. The energy values can be determined immediately from the requirement

that the asymptotic solutions should contain only positive integer powers of meson emission operators. The possibility that the asymptotic solution for the ground state will give a good description of the situation at small distances from the core of nucleons is discussed. The result is consistent with the view that the production of meson showers by high energy nucleon collisions is due to the shaking off of meson clouds during collisions. No inconsistency with the low energy experiments is introduced by this picture of shower production. (auth)

18413

A PROPOSED STRONG INTERACTION OF MUONS. G. Marx and K. L. Nagy (Roland Eötvös Univ., Budapest). Nuclear Phys. 12, 125-32(1959) June (3).

The existence of a moderately strong universal interaction between baryons-K-mesons and muons-K-mesons has been assumed. This assumption may explain the anomalously large mass of muons. The interaction further naturally gives rise to several other effects, e.g. to a short range strong singular muon-nucleon potential. These effects do not seem to contradict the experiments. (auth)

18414

PION-BARYON INTERACTIONS AND "CLOSED LOOP" PHENOMENA. A. N. Mitra (Muslim Univ., Aligarh, India). Nuclear Phys. 12, 133-8(1959) July (1).

The effect of strong pion-hyperon interactions on $\pi^0 \rightarrow 2\gamma$ decay and $\pi-\pi$ interaction, both of which are "closed loop" processes, is examined. It is found that while the interaction of pions with hyperons helps to reduce the decay rate of π^0, it leads to an unreasonably strong $\pi-\pi$ attraction. To reduce the attraction it is suggested that either the meson-meson divergence should not be renormalized or $\pi-K$ interactions of the Yukawa type should be invoked. (auth)

18415

THE INTERACTIONS OF POSITIVE K-MESONS WITH NUCLEI IN PHOTOGRAPHIC EMULSION AT ENERGIES IN THE REGION (240 TO 300) Mev. D. Keefe, A. Kernan, and A. Montwill (University Coll., Dublin) and M. Grilli, L. Guerriero, and G. A. Salandin (Università, Padua and Istituto Nazionale di Fisca Nucleare, Padua). Nuovo cimento (10) 12, 241-63(1959) May 1.

Interactions of K^+ mesons with emulsion nuclei have been observed in a scan of 185 m of track. The analysis yielded information on scattering reactions K^+-p and K^+-n and charge-exchange reactions. An energy dependence of the three cross sections up to 350 Mev was obtained from the collected data of different laboratories working with emulsion technique. The phase-shift analysis in the 300-Mev region shows a contribution of T = 0 state of the same order of magnitude as that of T = 1 state. An interference seems to be present between the P-waves of the two states, depressing the K^+-n scattering cross section and raising the charge-exchange cross section. (auth)

18416

DISPERSION RELATIONS FOR ASSOCIATED PRODUCTION. Y. S. Jin (Swiss Federal Inst. of Tech., Zurich). Nuovo cimento (10) 12, 455-68(1959) June 1.

Formal derivation of relativistic dispersion relations for the associated production of strange particles by pion-nucleon collision is presented without trying to give rigorous proof of derivation concerning the analytic continuation of the causal amplitudes into the unphysical region. Matrix structure of causal amplitudes in spin and isospin space is studied. Dispersion relations are obtained in covariant form as well as in Breit system separately for spin-flip or nonspin-flip and isospin-flip or nonisospin-flip processes of the associated production. (auth)

18417

ON THE TRANSVERSE MOMENTA OF SECONDARIES IN COSMIC-RAY JETS. E. M. Friedländer (Inst. of Atomic Physics, Bucharest). Nuovo cimento (10) 12, 483-7(1959) June 1.

It is shown that the correct measure, valid for high energies also, for the departure from the condition $v = \beta_c$ is given by the transverse momentum p_Γ. The transverse momentum p_Γ on the c.m.s. angle Ψ can also be used to discriminate between various theories of meson production. (C.G.J.)

18418

ON THE SCATTERING OF K-MESONS BY NUCLEONS. C. Ceolin, V. De Santis, and L. Taffara (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 12, 502-12(1959) June 16.

The problem of the scattering of K mesons by nucleons is considered in terms of direct pseudoscalar coupling K-Y-N. The purpose is to determine values of the pseudoscalar coupling constants g_Λ^2 and g_Σ^2 capable of fitting the experimental behavior of K-proton elastic and K-neutron elastic and charge exchange cross section. It has been found that, in the limits of the approximation used, no value can be determined for the ratio $Q = g_\Lambda^2/g_\Sigma^2$ which fits the experimental cross section for all the energies investigated. Therefore it may be deduced that, assuming the quantum numbers attributed by the Gell-Mann-Nishijima scheme as correct and the theoretical procedure used as sufficiently reliable, the K-nucleon scattering phenomena cannot be interpreted in terms of K-Y-N direct coupling only. (auth)

18419

RESULTS ON ANTIPROTON-PROTON ELASTIC SCATTERING. G. Baroni, G. Bellettini, C. Castagnoli, M. Ferro-Luzzi, and A. Manfredini (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 12, 564-70(1959) June 16.

Fifteen antiproton-proton elastic scatterings are described: the angular distribution and the cross section $\sigma_{el} = (65.7 \pm 17)$ mb are obtained. By averaging the results with those obtained by other laboratories under similar conditions, it is found that $\sigma_{el} = (70.9 \pm 12.7)$ mb. Both angular distribution and cross section are in agreement with the predictions of Ball-Chew's theory. Four events were used for an accurate determination of the antiproton mass: $m_{\bar{p}} = (0.998 \pm 0.015)$ proton masses. (auth)

18420

ON THE DIRAC EQUATION FOR BARYONS. N. Dallaporta and T. Toyoda (Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). Nuovo cimento (10) 12, 593-601(1959) June 16.

Making use of physical considerations, possible forms of direct interaction between baryons and other fields in Gürsey's equation have been investigated, and a new interpretation of the eight-component spinors as representing for example $(p\text{-}\Xi^-)$ or $(\Sigma^+\text{-}\Sigma^-)$ is proposed. It enables one to relate the boson conjugation and the spinor conjugation proposed by Budini, Dallaporta, and Fonda in an organic way with the single fundamental equation. The most important conservation laws of electric current and baryon number are automatically

guaranteed in the formalism, independently from each other. (auth)

18421

NUCLEON STRUCTURE AND PION-PION INTERACTION. D. I. Blohinčev, V. S. Barašenkov, and B. M. Barbašov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R.). Nuovo cimento (10) 12, 602-10(1959) June 16.

The density of a meson cloud in a nucleon is calculated on the basis of the extended source theory. The nucleon periphery is determined as a region of the applicability of the one-meson state. The pion-pion interaction cross section is estimated. The coefficient of pion absorption in a nucleon found experimentally is compared with that calculated by the optical model. (auth)

18422

ON THE ELASTIC SCATTERING OF LOW ENERGY K^- ON PROTONS. D. Amati (Università, Rome and Istituto Nazionale di Fisica Nucleare, Rome) and E. Galzenati and B. Vitale (Università, Naples and C.N.R.N., Naples). Nuovo cimento (10) 12, 627-9(1959) June 16.

If K mesons are pseudoscalar with respect to Λ and Σ, the characteristic behavior of the elastic cross section should be expected without imposing any new feature to K^--p interaction, or one might take this as a further evidence for the pseudoscalarity of heavy mesons. (C.J.G.)

18423

DECAY OF THE CASCADE PARTICLES. W. B. Teutsch (Tufts Univ., Medford, Mass.); S. Okubo (Univ. of Rochester, N. Y.) and E. C. G. Sudarshan (Harvard Univ., Cambridge, Mass.). Phys. Rev. 114, 1148-9 (1959) May 15.

A phenomenological investigation of the decay of the cascade particles is presented. Several possible correlation measurements, which exploit the large asymmetry in Λ^0 decay as an analyzer of Ξ, are suggested. One of these experiments does not require polarized Ξ's. The relation to the theory of universal weak interactions is briefly discussed. (auth)

18424

MASS-550 PARTICLE. M. Conversi, G. M. De Munari, A. Egidi, E. Fiorini, S. Ratti, C. Rubbia, C. Succi, and G. Torelli (Università di Milano, Pisa, Italy and Istitutio Nazionalio di Fisica Nucleare, Pisa, Italy). Phys. Rev. 114, 1150-1(1959) May 15.

At an altitude of 2550 m a search has been carried out for the 550-mass particle which, at the Moscow International Conference in May 1956, was reported to exist with an abundance of 0.5% relative to muons of the same range. Preliminary evidence against this datum is now reinforced by the results of a new series of measurements in which particles heavier than pions but lighter than protons are selected by means of two Čerenkov counters. The mass of each selected particle is derived from measurements of energy loss in a proportional scintillator, and range in a large multiplate cloud chamber. The latter alone yields substantial information on the nature of the stopping particles. No example of a mass-550 particle has been found out of the 25 expected on the basis of the reported abundance. (auth)

18425

$\Xi^- - \Xi^0$ MASS DIFFERENCE. J. J. Sakurai (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 114, 1152(1959) May 15.

The electromagnetic self-energies of Ξ^- and Ξ^0 are discussed with reference to symmetry models of strong interactions. (auth)

18426

CHARGE RADIUS OF PION. Riazuddin (Imperial Coll. of Science and Tech., London). Phys. Rev. 114, 1184-6 (1959) May 15.

Using a dispersion relation for Compton scattering of virtual photons on pions, the charge radius of the pion is analyzed in terms of $\pi^\pm - \pi^0$ mass difference. It is found to be of the order of magnitude 0.46×10^{-13} cm–0.56×10^{-13} cm. (auth)

18427

PROTONS IN THE EARTH'S MAGNETIC FIELD. Stanley C. Freden and R. Stephen White (Univ. of California, Livermore). Phys. Rev. Letters 3, 9-11(1959) July 1.

The identity, flux, and energy distribution of particles trapped in the earth's magnetic field were determined for those particles which penetrate more than 6 g/cm^2 of material. Nuclear emulsions exposed to the Van Allen radiation belt by a Thor-Able ballistic missile were used in the measurements. The separation of protons and electrons was done unambiguously for proton energies up to 700 Mev by measuring the ionization of their tracks. (W.D.M.)

18428

VAN ALLEN BELT PROTONS FROM COSMIC-RAY NEUTRON LEAKAGE. Wilmot N. Hess (Univ. of California, Berkeley). Phys. Rev. Letters 3, 11-13 (1959) July 1.

One of the sources of particles for the Van Allen radiation belt is the decay of cosmic-ray neutrons leaking out of the atmosphere of the earth. Recently the cosmic neutron energy spectrum was measured, and from this, by use of a multigroup neutron diffusion calculation, the neutron leakage was calculated. Some of the neutrons leaking out of the atmosphere decay in the earth's magnetic field and are trapped. From this leakage the equilibrium proton energy spectrum in the inner Van Allen belt is calculated. (W.D.M.)

18429

DIRECT PROOF OF θ_1^0 NEUTRAL DECAY. J. L. Brown, H. C. Bryant, R. A. Burnstein, R. W. Hartung, D. A. Glaser, J. A. Kadyk, D. Sinclair, G. H. Trilling, J. C. Vander Velde, and J. D. van Putten (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters 3, 51-2(1959) July 1.

Although the neutral decay mode $\theta_1^0 \rightarrow \pi^0 + \pi^0$ is expected to occur in addition to the well-known charged mode $\theta_1^0 \rightarrow \pi^- + \pi^+$, there has been no complete experimental proof of its existence because of the difficulty of detecting the neutral decay products with high efficiency. An experiment is described in which the Bevatron 1.0-Bev π^- beam was allowed to fall on a liquid xenon bubble chamber. Out of 80,000 photographs scanned, ten four-gamma events were found which are interpreted as $\theta_1^0 \rightarrow 2\pi^0 \rightarrow 4\alpha$. (W.D.M.)

18430

EXPERIMENT ON CHARGE INDEPENDENCE IN PION INTERACTIONS. D. Harting, J. C. Kluyver, A. Kusumegi, R. Rigopoulos, A. M. Sachs, G. Tibell, G. Vanderhaeghe, and G. Weber (CERN, Geneva). Phys. Rev. Letters 3, 52-4(1959) July 1.

An experiment was performed at 600-Mev proton energy on the reactions $p + d \rightarrow H^3 + \pi^+$ and $p + d \rightarrow He^3 + \pi^0$ for which the charge independence hypothesis predicts a ratio of the differential cross sections to be 2 at any c.m. angle. The c.m. energy of the emerging pions is 220 Mev, well above the $(3/2, 3/2)$ resonance. The cross

sections are compared by detecting only the recoiling nuclei, which are identified by momentum and time-of-flight selection. The final result for the ratio of the cross sections at a c.m. angle of 52° is R = 2.26 ± 0.11. (W.D.M.)

18431

SEARCH FOR RARE DECAY MODES OF THE μ^+ MESON. Juliet Lee and N. P. Samios (Columbia Univ., New York). Phys. Rev. Letters 3, 55-6(1959) July 1.

In an attempt to detect the two decay modes of the μ^+ meson, $\mu^+ \rightarrow e^+ + e^- + e^+$ and $\mu^+ \rightarrow e^+ + \nu + \bar{\nu} + e^+ + e^-$, slow π^+ mesons were stopped in a liquid hydrogen bubble chamber placed in a magnetic field of 8800 gauss. The experiment consisted in examining the μ^+ endings for those events which had 3 prongs and then measuring the vector momenta of these secondaries. From a total sample of 2.2×10^5 μ^+'s, three events were found where three charged prongs emerged from the μ^+ ending. The total energy of the three secondaries was in each case 51 ± 3.5, 55 ± 1.5, and 33 ± 2 Mev and their resultant momenta 47 ± 3.5, 54 ± 1.5, and 29 ± 2 Mev/c, respectively. (W.D.M.)

18432

PION PRODUCTION BY PIONS. Walton A. Perkins, John C. Caris, Robert W. Kenney, Edward A. Knapp, and Victor Perez-Mendez (Univ. of California, Berkeley). Phys. Rev. Letters 3, 56-7(1959) July 1.

In order to study the direct interaction of the incident pion with a virtual pion in the meson cloud surrounding a nucleon, the reaction $\pi + p \rightarrow \pi^+ + \pi^- + n$ was investigated in the energy range from 260 to 430 Mev. Negative pion beams impinged on a 4-in.-thick liquid hydrogen target. Measurements were taken for π^+ mesons emitted at 60, 90, 125, and 160° in the barycentric system for incident π^- kinetic energies of 317, 371, and 427 Mev. An integration was performed over the energy of the π^+ meson at each angle to obtain the angular differential cross section. (W.D.M.)

18433

PION PRODUCTION AND THE PION-PION INTERACTION. Leonard S. Rodberg (Univ. of California, Berkeley). Phys. Rev. Letters 3, 58-9(1959) July 1.

The cross sections for $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ at incident energies between 260 and 430 have been measured in a previous experiment. A theoretical interpretation of these results is presented. An attempt is made to fit the results by using a direct pion-pion interaction. The contribution from the interaction of the incident pion with a pion in the nucleon cloud was computed using the impulse approximation. (W.D.M.)

18434

SUPPRESSION OF P-STATE CAPTURE IN (K^-,p) ATOMS. T. B. Day, G. A. Snow, and J. Sucher (Univ. of Maryland, College Park). Phys. Rev. Letters 3, 61-4(1959) July 1.

It is of importance, in studying the reactions of K^- mesons at rest in liquid hydrogen or deuterium, to have some idea of the atomic orbit from which the K mesons are captured. Calculations on 3600 K^- mesons indicate that $\lesssim 1\%$ will ever reach the 2P level. The result implies that when a K^- meson comes to rest in liquid hydrogen, no mesonic x rays should be produced and the capture reaction essentially occurs with the relative orbital angular momentum of the (K^-,p) system equal to zero. (W.D.M.)

18435

DE-EXCITATION OF μ-MESONIC ATOMS. N. A. Krall and E. Gerjuoy (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev. Letters 3, 142-4(1959) Aug. 1.

It has been shown that during the de-excitation of a μ-mesonic atom, as the μ seeks its ground state, some nonradiative process competes much more favorably with radiative transitions than does the usual Auger process. It has been suggested that collisions with neighboring atoms could cause the μ meson to fall from the 2p to the 1s level, with the released energy used to eject an electron from the colliding atom. The possibility is discussed of collisional de-excitation of the radiating 2p mesonic atom level to the metastable 2s level, whose radiative lifetime is long enough to permit Auger or other nonradiative decay from the n = 2 to the ground n = 1 state. (W.D.M.)

18436

ELECTRON AND POSITRON POLARIZATION. Lorne A. Page (Univ. of Pittsburgh). Revs. Modern Phys. 31, 759-81(1959) July.

The various methods for analyzing electron and positron polarization are discussed. The methods and physics of "first-order" and many "second-order" experiments are emphasized. The Mott scattering method, the energy term $\sigma \cdot H$, and the "Møller" and "Bhabha" scattering processes are discussed in full. (C.J.G.)

18437

PARITY EXPERIMENTS IN BETA DECAYS. C. S. Wu (Columbia Univ., New York). Revs. Modern Phys. 31, 783-90(1959) July.

A discussion of the two-component theory of the neutrino and its application to lepton conservation and π-μ-e decays is given. The interactions responsible for beta decay are enumerated. (C.J.G.)

18438

Mu CAPTURE, BETA DECAY, AND Pi-MESON DECAY. M. L. Goldberger (Princeton Univ., N. J.). Revs. Modern Phys. 31, 797-801(1959) July.

To study the role of strong interactions in Fermi processes, the four functions deduced from invariance principles are investigated using dispersion techniques. The effective vector interaction matrix element is analyzed in similar manner. A discussion of the π meson decay mode $\pi^- \rightarrow \mu^- + \nu^-$ is given. (C.J.G.)

18439

STRANGE PARTICLE DECAY PROCESSES AND THE FERMI INTERACTION. R. H. Dalitz (Univ. of Chicago). Revs. Modern Phys. 31, 823-33(1959) July.

A survey is given for the possibility of accounting for strange particle decays by the addition of further terms of a weak interaction current J_μ, but which do not conserve strangeness. Pionic decay modes for strange particles are described in terms of the current J_μ and four-fermion coupling of the form V-A. The possibility of isotopic spin relationships in weak decay processes has been considered in connection with the isotopic spin character of the weak interaction currents. Leptonic modes of strange particle decay are discussed. (C.J.G.)

18440

SCATTERING OF HIGH ENERGY ELECTRONS ON LIGHT NONSPHERICAL NUCLEI. E. V. Inopin and B. I. Tishchenko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 17-29(1959) Jan.-Feb. (In Ukrainian)

Formulas are obtained defining cross sections of

elastic and non-elastic (with excitation of the rotating levels of nuclei) scattering of high-energy electrons on nonspherical nuclei. The calculations are made in the Born approximation, which is sufficiently exact in the case of light nuclei. It was shown that the nonsphericity results in an apparent increase of the nucleus radius, additional elastic scattering is caused by the presence in the nucleus of a spin $I > \frac{1}{2}$, and the calculated cross section of the excitation at the 1.37-Mev level in the Mg^{24} nucleus qualitatively agrees with the experiment. (auth)

18441

NEUTRON SCATTERING ON PROTONS WITH PAIR FORMATION OF DOUBLETS. Yu. M. Lomsadze, V. I. Lend'el, and I. Yu. Krivs'kii (Uzhgorod State Univ.). Ukrain. Fiz. Zhur. 4, 123-5(1959) Jan.-Feb. (In Ukrainian)

A hypothesis is postulated on the nature of π-meson doublet formation of two types, which differ from each other in that one is scalar and the other is pseudoscalar. An analysis of theoretical and experimental data on the pseudoscalar character of π mesons shows that in principle there are no discrepancies between the data and the hypothesis. The hypothesis is applied to the n-p scattering processes. (R.V.J.)

18442

MOMENTUM SPECTRUM OF PARTICLES OF THE HARD COMPONENT OF COSMIC RAYS AT AN ALTITUDE OF 9 km. L. T. Baradzei, M. V. Solov'ev, Z. I. Tulinova, and L. I. Filatova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1617-20(1959) June. (In Russian)

With aid of a cloud chamber in a magnetic field the momentum spectrum of particles of the hard component of cosmic rays was obtained at an altitude of 9 km for momentum values lying between 0.3×10^9 and 6×10^9 ev/c. In the indicated momentum range, the particles were separated with respect to charge. It is found that in the (1 to 5)10^9 ev/c momentum range protons comprise (50 ± 10)% of the total number of particles. (auth)

18443

REACTION $p + p \rightarrow p + p + \pi^0$ IN THE ENERGY RANGE FROM THE THRESHOLD TO 665 Mev. A. F. Dunaitsev and Yu. D. Prokoshkin (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1656-71(1959) June. (In Russian)

The angular distributions of π^0 mesons produced in proton-proton collisions were investigated at 400 to 665 Mev. The distributions were found to be close to isotropic, in agreement with the phenomenological resonance theory of S. Mandelstam. The total cross sections were measured in the energy range 313 to 665 Mev. At energies above 400 Mev the main contribution to the reaction cross section is given by the resonant transitions. At the lower proton energies the nonresonant Ss transition becomes essential, its contribution to the total cross section being $0.032\eta^2 m \times 10^{-27}$ cm^2. The comparison of the measured cross sections of neutral and charged pion production with those calculated from the resonance theory makes it possible to conclude that the transition with the total angular momentum J = 2 is preferential. (auth)

18444

DEPOLARIZATION OF μ^+ MESONS IN NUCLEAR EMULSIONS. A. O. Waissenberg, N. V. Rabin, and V. A. Smirnitskii (Inst. of Theoretical and Experimental Physics, Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1680-6(1959) June. (In Russian)

The asymmetry coefficient in $\pi^+ - \mu^+ - e^+$ decay was measured in an ordinary and diluted NIKFI-R emulsion as well as in this emulsion placed in a strong magnetic field. An analysis of the results obtained and also of those contained in the literature indicates that the asymmetry coefficient in the NIKFI-R emulsion ($a = -0.077 \pm 0.012$) is significantly smaller than that for the Ilford G-5 emulsion ($a = -0.139 \pm 0.014$). A two-fold dilution of the NIKFI-R emulsion with gelatin leads to a sharp increase of the asymmetry coefficient ($a = -0.127 \pm 0.028$). The polarization in the NIKFI-R emulsion is restored by application of a magnetic field, the asymmetry coefficient being increased up to $a = -0.28 \pm 0.02$ at a field strength of 17,000 G. (auth)

18445

A CASE OF A SHARP INCREASE OF THE COSMIC RAY INTENSITY IN THE STRATOSPHERE. N. P. Rymko, V. F. Tulinov, and A. N. Charakhch'yan (P. N. Lebedev Physics Inst., Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1687-9(1959) June. (In Russian)

An increase of the intensity of the cosmic radiation was observed in the stratosphere on July 8, 1958, at a latitude of 64°N. At an altitude of 30 km the intensity was more than twice the normal value. On the other hand, at latitudes of 51 and 41° no increase was observed. (auth)

18446

GENERATION OF π-MESONS BY HIGH ENERGY COSMIC-RAY ALPHA-PARTICLES. A. A. Loktionov and Zh. S. Takibaev (Inst. of Nuclear Physics, Academy of Sciences, Kazakh, S.S.R.) Zhur. Eksptl'. i Teoret. Fiz. 36, 1697-1702(1959) June. (In Russian)

The experimental data are compared with the hydrodynamical theory of multiple meson production. It is shown that for showers with an energy $\gtrsim 10$ Bev per nucleon the results of an analysis of the observed star parameters do not contradict the concept of an interaction between the incident alpha particle and a "tunnel" consisting of the nucleons of the target nucleus. (auth)

18447

COMPARISON OF THE DIFFERENTIAL CROSS SECTIONS FOR THE (d,p) AND (d,t) REACTIONS. A. B. Kurepin and V. G. Neudachin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1725-30(1959) June. (In Russian)

The (d,t) reaction is regarded as a special case of a stripping reaction between two complex systems. The reduced widths derived from the (d,t) and (p,d) reactions by choosing various triton wave functions are compared. The neutron wave function relative to the deuteron in triton which yields best agreement with the experiments is found. A value of ≈ 0.40 is derived for the probability of finding the triton in the (deuteron + neutron) state. (auth)

18448

MONTE-CARLO COMPUTATION OF ELECTROMAGNETIC CASCADES WITH ACCOUNT OF THE EFFECT OF THE MEDIUM ON THE BREMSSTRAHLUNG. A. A. Varfolomeev and I. A. Svetlolobov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1771-81(1959) June. (In Russian)

Electromagnetic cascades initiated by 10^9, 10^{10}, 10^{11}, 5×10^{11}, 10^{12}, and 3×10^{12} ev primary electrons are computed for depths up to 2.8 radiation units. The Monte Carlo method was employed. Real (nonasymptotic)

cross sections for elementary electromagnetic processes in the nuclear emulsion were taken into account. Two types of calculations were carried out: those based on the Bethe-Heitler formulas and those based on formulas which take into account the effect of multiple scattering and polarization of the medium on bremsstrahlung. (auth)

18449

RADIATIVE DEVIATIONS FROM THE COULOMB LAW AT SMALL DISTANCES. V. G. Vaks. Zhur. Eksptl'. i Teoret. Fiz. 36, 1882-9(1959) June. (In Russian)

Radiative corrections to the Dirac equation in a Coulomb field are considered for distances $r \ll \hbar/mc$. The calculations are carried out in the first order in e^2 and in the second order in $Ze^2/\hbar c$. The resultant change in the Coulomb singularity of the wave functions turns out to be small and only with difficulty can be differentiated from the effect due to the finite dimensions of the nucleus. (auth)

18450

ON THE POSSIBILITY OF DETERMINING THE π-π-SCATTERING AMPLITUDES BY ANALYSIS OF THE $\gamma + p \rightarrow N + \eta + \pi$-REACTIONS NEAR THE THRESHOLD. A. A. Ansel'm and V. N. Gribov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1890-3(1959) June. (In Russian)

It is shown that a study of the $\gamma + p \rightarrow p + \pi^+ + \pi^-$, $p + \pi^0 + \pi^0$, $n + \pi^+ + \pi^0$ reactions near their threshold permit the determination of the scattering amplitudes of π mesons on π mesons for zero energy if the meson-meson interaction is of a resonance nature and the determination of a certain combination of these amplitudes if the interaction is not of a resonance nature. (auth)

18451

PROTON POLARIZATION IN SCATTERING ON C^{12}. S. A. Baldin and V. I. Man'ko. Zhur. Eksptl'. i Teoret. Fiz. 36, 1937(1959) June. (In Russian)

Calculations were made of the polarization and cross section dependence on energy in ($p-C^{12}$) scattering at 2.5 to 4.5 Mev and scattering angles from 0 to 180° in the cms. The obtained results are plotted. Polarization values (especially at 30 to 90°) proved to be very sensitive to D-phase values. Changes of the $D_{3/2}$ phase at 4.5 Mev at 5° multiplies the value of polarization at the front angles 2 to 3 times while the cross sections change only 5 to 10%. It was found that polarization can be used in phase analysis and the utilization of carbon for production and analysis of proton beams of 2 to 5 Mev is more effective than He^4. (R.V.J.)

18452

SATURATION IN HYPERON SYSTEM. V. A. Filimonov (Inst. of Nuclear Physics, Electronics and Automatics, Tomsk). Zhur. Eksptl'. i Teoret. Fiz. 36, 1941-2(1959) June. (In Russian)

The binding energy in a system of nucleons and Λ particles was calculated with the assumption that Wigner-type, short-activity forces act between two Λ and between Λ and N, resulting in zero energy bonds. For nucleon-nucleon interactions considerations are given to the repulsion at the range $r_c = 0.4\phi$. The nucleons and hyperons are considered as a degenerate Fermi gas. With such assumptions and considering that Λ particles are distributed with constant density inside the sphere $R = r_0 L^{1/3}$, the condition of $L(M_\Lambda - M_N) + B(A + L) + T_N + T_\Lambda + U < 0$ is fulfilled when $r_0 \approx 0.9\phi$. Moreover, the minimum energy is reached with a nucleon distribution inside the sphere of the same radius and the ratio of the number of nucleons and Λ particles is $A/L \approx 1.6$. With the fulfillment of the above conditions, the proton-neutron state is metastable in relation to the transition into hyperon-nucleon states. (R.V.J.)

18453

THE POSSIBLE METHODS FOR ρ^0-MESON DETECTION. V. G. Zinov, A. D. Konin, S. M. Korenchenko, and B. Pontekorvo (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1948-9(1959) June. (In Russian)

Previous studies of complete π^--ρ interaction cross sections at 150 to 180 Mev indicated the existence of ρ^0 mesons. A more realistic principle and method for detecting ρ^0 mesons is offered, based on the π^--ρ interaction cross section energy dependence. In the reactions $\pi^- + \rho \rightarrow \pi^- + \rho$ and $\pi^- + \rho \rightarrow \pi^0 + n$ the energy dependence anomaly appears at the threshold of the $\pi^- + \rho \rightarrow \rho^0$ reaction. Studies of the angular distribution at this point offer data on the relative parities of ρ^0 and π. It was assumed that the lifetime of the produced ρ^0 is high in comparison with the nuclear time $\hbar/m_\pi c^2$, i.e., that the threshold of ρ^0 production is explicit. The suggested method can be used in seeking any neutral meson with sufficiently small natural width. The analysis was made only of ρ^0, with the assumption that they differ from π^0 only in spin (T = 0). In such event, the ρ^0 is not able to decay fast into two π mesons (due to the conservation of parity) or three π mesons (conservation of quantum number G), but decays along the reaction channel $\rho^0 \rightarrow \gamma + \gamma$, or with a sufficiently higher mass, decays along the channel $\rho^0 \rightarrow \pi + \pi + \gamma$. With ρ^0 mass above 560 Mev/c^2, the method is not applicable. (R.V.J.)

18454

THE S-MATRIX STRANGENESS AND ρ^0 MESON. V. I. Gol'danskii and Ya. A. Smorodinskii (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1950-1(1959) June. (In Russian)

The existence of a second neutral meson (ρ^0) with a zero spin and strangeness was discussed in previous works along with a method for its confirmation. A method based on studies of the reaction energy dependence near the new particle production threshold is discussed. The method was used previously for detecting dineutrons in studies of the energy dependence of the cross sections in neutron elastic scattering by nuclei near the reaction (n, 2n) threshold. An attempt is made to determine the existence of ρ^0 using the elastic scattering cross section of π mesons by < 270-Mev protons. If the ρ^0 production threshold would respond to the π meson energy below 270 Mev, the relatively fast decay of $K^+ \rightarrow \pi^+ + \rho^0$ ($\Delta T = 1/2$) would be possible; however, such an event was not observed. The cross section of the examined process had two types of strangeness. The strangeness related to an "isobar" state, $\pi^- + \rho$ isobar ($T = 3/2$, $I = 3/2$). The other strangeness is at the new particle production threshold, $\pi^- + \rho \rightarrow \rho^0 + n$. (R.V.J.)

18455

COLD NEUTRON STORAGE. Ya. B. Zel'dovich. Zhur. Eksptl'. i Teoret. Fiz. 36, 1952-3(1959) June. (In Russian)

Experiments were carried out in order to find a means for retaining slow neutrons. It is suggested that the neutrons be subjected to preliminary cooling in liquid helium. Due to the long lifetime of the slow neutron, within a few seconds the concentration becomes equal to Maxwellian equilibrium. The main difficulties are related to the necessity of retaining a large volume of helium to accommodate the long paths in helium (50 cm).

With a reactor flux of 10^{12}, the retarded flux at 3°K would be 10^{11}, corresponding to a thermal neutron density of $5 \times 10^{6}/cm^{-3}$ and a cold flux of $50/cm^{-3}$. Consequently, under favorable conditions it is possible to store 5×10^{7} cold neutrons. (R.V.J.)

18456

DETERMINATION OF THE FREQUENCY OF SLOW MESON CAPTURE BY LIGHT AND HEAVY NUCLEI IN PHOTOEMULSION. D. A. Kopylova, Yu. B. Korolevich, N. I. Petukhova, and M. I. Podgoretskii (Joint Inst. of Nuclear Research Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1955-6(1959) June. (In Russian)

Descriptions are given of a simple method for determining the percentage of interactions of light nuclei (C, N, and O) and heavy nuclei (Ag, Br, etc.) without special emulsions. Descriptions are confined to the nuclear capture of stopped π^-. If the meson produces Auger electrons, the capture is in a heavy nucleus. When the σ_π star contains particles with ≤ 50 μ tracks, the capture is in a light nucleus. 349 σ_π stars were tested. The method can also be used for determining the frequency of slow K-meson capture by light and heavy nuclei in emulsions. (R.V.J.)

Heat Transfer and Fluid Flow

18457 AFOSR-TN-59-273

Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

THE ELECTRIC SPARK METHOD FOR QUANTITATIVE MEASUREMENTS IN FLOWING GASES. H. J. Bomelburg, J. Herzog, and J. R. Weske. Jan. 1959. 31p. Contract AF49(638)-385. (BN-157; AD-212707). OTS.

The technique presented makes use of a series of pulsed sparks of judiciously adjusted intensity generated by electronic equipment. When an electric spark traverses an air gap, it creates a path of momentarily ionized air particles which, for the brief period of $\Delta T \leq 10^{-4}$ sec, during which appreciable ionization persists, retains a very low electric resistance. A succeeding spark will follow the path previously ionized, thereby re-illuminating it. If the spark traverses a stream of air, its ionized path will be displaced by the moving air during the time interval between sparks. Successive sparks choosing the displaced trace map the displacement and thereby give an indication of the motion of the air. (W.L.H.)

18458 JPL-PR-20-382

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

THE COMPRESSIBLE, VISCOUS, HEAT-CONDUCTING VORTEX. Progress Report. Leslie M. Mack. May 1, 1959. 29p. Contract DA-04-495-OND-18.

The plane, steady, laminar vortex flow of a compressible, viscous, heat-conducting, perfect gas is treated. The vortex can be generated and maintained by a circular cylinder rotating in an infinite extent of fluid. When the viscosity coefficient is constant, the flow is irrotational. In addition, when the Prandtl number is equal to $\frac{1}{2}$, the flow is isentropic. For arbitrary Prandtl numbers, simple relations for the flow quantities are given. When the viscosity coefficient is a function of temperature, the flow is rotational and the temperature level of the vortex is a parameter. Two rotational solutions are presented: an exact successive-approximations solution, and an approximate solution based on an assumed variation of the viscosity coefficient with radius. The computations, performed for air with a constant Prandtl number of 0.70, include the distribution through the vortex of velocity, Mach number, pressure, temperature, density, stagnation temperature, and stagnation pressure. The supersonic region of the vortex is found to be very narrow. The Mach-number infinity radius is located at about 60% of the sonic radius, the particular value depending on the temperature level of the vortex. The stagnation temperature decreases with decreasing radius to about 65% of the sonic radius and then increases again. With the rotational solution, there is no special value of the Prandtl number for which the flow is either isentropic or has constant stagnation temperature. (auth)

18459 NYO-6361

Princeton Univ., N. J. Project Matterhorn.

SELECTION OF MATERIAL FOR A TUBE WHICH IS SUBJECTED TO A PULSATING HEAT FLUX ACTING ON THE INSIDE DIAMETER. Technical Memorandum No. 16. Michael Rashevsky. May 24, 1955. 32p. $6.30 (ph), $3.00 (mf) OTS.

Comparative stress calculations were made for four metals and two glasses under thermal shock load. Thermal stress distribution curves for a thin wall cylinder are given, and a general summary of the thermal shock problem is included. (auth)

18460 SCTM-222-59(57)

Sandia Corp., Albuquerque, N. Mex.

AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THE STEADY-STATE FLOW IN SMALL BORE TUBING WITH REDUCED SIZE STRAIGHT-THROUGH FITTINGS CONNECTED AT THE TUBING EXTREMITIES. Arnold L. Ducoffe. July 6, 1959. 31p. Contract [AT(29-1)-789]. $7.80 (ph), $3.30 (mf) OTS.

The results of analysis present the effect of system geometry, such as tube length, diameter, and fitting diameter, and pressure ratio on the steady-state rate of mass flow through a typical tube and fitting combination. The data indicate that reduced-size fittings and long line lengths serve as chokes on the rate of flow of air through the system. Predictions are made as to the optimum tube diameter once the fitting diameter and line length are determined. In addition, the data show that a system comprised of lines, fittings, and a sensing volume is not analogous to a simple volume-orifice combination. (auth)

18461

SIMILARITY PARAMETERS FOR SURFACE MELTING OF A BLUNT NOSED BODY IN A HIGH VELOCITY GAS STREAM. Lester Lees (Space Tech. Labs., Inc., Los Angeles). ARS Journal 29, 345-54(1959) May.

By employing a simple model for the two-phase boundary layer produced by surface melting, "scaling laws" are obtained for the regime in which vaporization does not occur at the gas-liquid interface. When the liquid is fairly viscous, the gas boundary layer is virtually independent of the liquid film. The temperature rise across this film depends not only on the local heat transfer rate, but also on the difference in total enthalpy across the gas boundary layer. Thus, tests in rocket exhaust jets may not simulate vaporization or film instability phenomena that could occur in flight. Calculations of the behavior of Corning glass No. 7740 are carried out for some typical flight conditions. One interesting result is the low value of the liquid film Reynolds number, which indicates that the liquid film is

almost certainly laminar. This liquid-solid system absorbs about 1125 Btu/lb, or about six times the heat capacity of a nonmelting copper heat sink. A study of the effect of mass addition to the gas phase shows that the amount of heat "blocked" by this process is sensitive to the total enthalpy difference across the gas boundary layer. The possible increase in effective heat capacity with vaporization at the gas-liquid interface is quite substantial at hypersonic flight velocity. This phenomenon can also be analyzed along the lines of the present paper. (auth)

18462

CRITICAL HEAT LOADINGS FOR FLOWING WATER IN TUBES. I. T. Alad'ev, L. D. Dodonov, and V. S. Udalov. Atomnaya Energ. 6, 74-8(1959) Jan. (In Russian)

Descriptions are given of the apparatus used for testing the critical heat loading of water at 21, 41, 81, 111, 181, and 201 atm pressure and flow rates of 1, 2, 5, and 8 m/sec. Critical heat loading at various Δt was determined and plotted. Comparisons of obtained and published data showed that the critical heat loading below the saturation temperature in a tube ($d > 8$ mm) and in channels of different configuration can be determined using the test data. Channel shape and size (diameter and clearance) effects on q_{crit}, apparently related to maximum steam bubble dimensions, indicate that the published data for lower pressures and flow rates should be checked. (R.V.J.)

18463

FUSED SALT THERMAL CONDUCTIVITY. Wallace R. Gambill (Union Carbide Nuclear Co., Oak Ridge, Tenn.). Chem. Eng. 66, No. 16, 129-30(1959) Aug. 10.

Calculations, using either Rao's or Osida's equation, of the atomic portion of the total thermal conductivity for various fused salts are presented in tabular form. (C.J.G.)

18464

EXAMPLES OF EXACT SOLUTIONS TO PROBLEMS ON THE PROPAGATION OF EXPLOSION WAVES IN A GRAVITATING GAS WHEN THE TEMPERATURE GRADIENT IS ZERO. E. V. Ryazanov (Steklov Inst. of Mathematics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 955-7(1959) June 11. (In Russian)

A solution is derived for the problem where, in the gas motion disturbance region, the temperature gradient is assumed to be absent—homothermal flow. The single dimension homothermal motion of a perfect gas in a natural gravitational field with spherical symmetry is described by a standard differential equation system with a partial derivative in which the condition $\partial T/\partial r = 0$ is used instead of the adiabatic equations. (R.V.J.)

18465

A FACILITY USED FOR WET STEAM COOLING EXPERIMENTS: PRESSURE DROP, HEAT TRANSFER AND BURNOUT. G. Bertolotti (Edisonvolta S.p.A, Milan); A. Cicchitti (Ansaldo S.p.A, Genoa); S. Finzi (Agip Nucleare, Milan); and M. Silvestri, G. Soldaini, and R. Zavattarelli (CISE, Milan). Energia nucleare (Milan) 6, 458-71(1959) July.

A facility designed to study the behavior of wet steam, for possible applications to reactor cooling, is described. With this facility it is possible to measure pressure drops, maximum (burnout) heat fluxes, and, possibly, heat transfer coefficients in cylindrical ducts of different geometry for steam–water mixtures flowing upward. The apparatus design, electrical heating system, safety system and temperature determination, quantity calculations, and preliminary operational tests and startup are described in some detail. (J.S.R.)

18466

AN INVESTIGATION OF HEAT EXCHANGE BETWEEN A HEATED SURFACE AND FLUIDIZED BED. Ya. Tsiborovskii and Ya. Roshak (Polytechnical Inst., Inst. of General Chemistry, Warsaw). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 1, 15-24(1959) Jan. (In Russian)

A method is worked out for making erosion tests on models of turbine blades in dust-laden gas flows of various temperatures and speeds, in which both the concentration and the size of the particles of ash may vary. The best method of protecting austentic steel from erosive wear is by means of the simultaneous saturation by carbon, chrome, and nitrogen, or the two latter elements, when the coefficient of resistance to erosion is increased by 10 or more times. The resistive qualities of steel at 650° after such saturation do not essentially deteriorate, and in a number of cases even improve somewhat. High resistance to erosive wear is caused by the presence in the diffusion layers of nitrides of chrome, type Cr_2N and CrN and of complex carbonitrides, by means of which a highhardened surface of the order of 1200 to 1500 kg/mm^2 and over is obtained. The character and mechanism of erosive wear is described, and it is shown that specific waves of wear are associated with the creep of surface layers of metal which may be formed when a cold blast of dust-laden air strikes iron, copper, aluminum and tin blades. (auth)

18467

EFFECTIVE HEAT CONDUCTIVITY OF A DEVELOPED FLUIDIZED (BOILING) BED. S. S. Zabrodskii (Inst. of Power, Academy of Sciences, Byelorussia SSR). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 1, 32-8(1959) Jan. (In Russian)

An analysis is given of experimental data on the effective heat conductivity of a fluidized bed. The numerical values of coefficients of heat exchange by a fluidized bed are shown to be inaccurate. A method is proposed for determining the coefficient of heat exchange with a fluidized bed taking into account the thermal resistance of the layer to the transfer of heat by effective heat conductivity. (auth)

18468

A METHOD OF APPLICATION OF CONTOUR INTEGRALS TO THE SOLUTION OF MONO-DIMENSIONAL PROBLEMS IN THE THEORY OF HEAT CONDUCTIVITY. D. V. Redozubov (All-Union Polytechnical Correspondence Inst., Vorkuta, Russia). Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 2, No. 1, 76-8 (1959) Jan. (In Russian)

An example is given to show the application of contour integrals to the solution of mono-dimensional problems in heat transfer theory. The solution is expressed in the form of an integral containing two arbitrary constants. The formulas for these constants are given. (J.S.R.)

18469

SOME RADIATOR DESIGN CRITERIA FOR SPACE VEHICLES. Joseph P. Callinan (Loyola Univ., of Los Angeles) and Willard P. Berggren (Univ. of Bridgeport, Conn.). J. Heat Transfer 81, 237-244 (1959) Aug.

Nonconvective radiators of single or double-active surface design are analyzed for surface temperature

distribution; also for view factors in the case of fin-and-tube geometry. Methods and examples of maximizing heat rejection per unit weight are given. (auth)

18470

EVALUATION OF HEAT TRANSFER SURFACES FOR NUCLEAR BOILERS. PART 1. PLAIN TUBING. B. G. Ediss, R. Bilsborough, and F. Carr (Nuclear Power Co., Ltd., Knutsford, Eng.). Nuclear Power 4, No. 39, 80-2 (1959) July.

The merits and demerits of plain tubes will guide in the determination of the relative advantages of the two methods of deployment, "staggered" formation and "in line" formation. The two methods are discussed in relation to gas side heat transfer coefficient and pressure drop. (C.J.G.)

18471

HEAT TRANSFER TO WATER FLOWING PARALLEL TO TUBE BUNDLES. Joel Weisman (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 78-9(1959) July.

A fuel element assembly consisting of cylindrical rods cooled by water flowing parallel to the axis is investigated. The results for square and triangular pitch lattices are plotted as a function of the ratio of the water flow area to the total cross sectional area of an infinite lattice. From the graph it may be seen that both lattice types yield essentially the same heat transfer coefficients at equivalent values of the ratio. (A.C.)

18472

SUPERSONIC NOZZLE FLOW WITH A REACTING GAS MIXTURE. Peter P. Wegener (California Inst. of Tech., Pasadena). Phys. Fluids 2, 264-75(1959) May-June.

An investigation has been made of the stationary supersonic nozzle flow of a reacting gas mixture of nitrogen tetroxide and dioxide carried at low concentration in nitrogen. A judicious choice of supply conditions and nozzle geometry made it possible to produce flows either in chemical equilibrium or in states between this and the frozen flow. The flow could be fully determined from pressure and area measurements and, by applying an equation for the reaction mechanism, rate constants of recombination could be found. The results of these measurements agreed with those obtained from independent optical absorption measurements, and the third-order rate constant for recombination was found to be 3×10^{14} cm^6 mole^{-2} sec^{-1} for $210 < T < 330$°K. Finally, experiments with stationary oblique shocks led to a determination of the dissociation rate constant. (auth)

18473

AN APPROXIMATE METHOD FOR INTEGRATING LAMINAR BOUNDARY LAYER EQUATIONS WITH HEAT-INTERCHANGE IN INCOMPRESSIBLE GAS. M. B. Skopets (Ushinskii Yaroslav Teacher's Inst.). Zhur. Tekh. Fiz. 29, 462-70(1959) Apr. (In Russian)

Equations based on a system of coherent moments (including zero moments) at the boundary line were used for solving the heat exchange problem at a plane laminar boundary layer. (tr-auth)

18474

CORRELATION BETWEEN ELECTRONIC AND PHONONIC CONTRIBUTIONS TO THE HEAT CONDUCTANCE OF STEELS. P. E. Krzhizhanovskii. Zhur. Tekh. Fiz. 29, 539-45(1959) Apr. (In Russian)

Experiments are carried out for determining the correlation between electron and phonon conductance in steel and the effects of composition, temperature and thermal treatments on the correlation. (tr-auth)

18475

STUDIES IN CONNECTION WITH STABILIZED GASEOUS DETONATION WAVES. J. A. Nicholls, E. K. Dabora, and R. L. Gealer. p. 766-72 of "Seventh Symposium (International) on Combustion." London, Butterworths Scientific Publications, [1959].

Cold hydrogen was injected at sonic velocity into a surrounding sonic hot air stream without the occurrence of combustion. Stagnation temperature of the air was 2,150°R and the pressure level at injection point was 283 psia. A high stagnation temperature combustible mixture was accelerated to a high Mach number and ignition initiated by a strong normal shock wave in the open jet. The resulting configuration proved to be extremely stable. Distance between shock wave and combustion zone corresponds to an ignition time delay of about 25 μsec. It is questionable whether the observed stable configuration can appropriately be called a standing detonation wave. The shock wave, in the case under consideration, exists whether combustion occurs or not, whereas the combustion maintains the shock wave in tube experiments. (C.J.G.)

Nuclear Properties and Reactions

18476 NP-7722

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy.

ON SOME FEATURES OF ANTIPROTON ANNIHILATION ON A DEUTERON. E. O. Okonov. 1959. 5p.

In the annihilation capture of an antiproton by a deuteron, pair production of strange particles may occur. Isotopic invariance, grouping the strange particles into charge multiplets, and cross sections of the pair production are discussed. (C.J.G.)

18477 SCR-88

New Mexico. Univ., Albuquerque.

TRANSPORT THEORY AND SPECTRAL PROBLEMS. G. Milton Wing. May 1959. 21p. $0.75(OTS).

Presented at American Mathematical Society Symposium on Reactor Theory, New York, April 1959.

A simple model of time-independent neutron transport on a line as a stochastic process, using the method of invariant imbedding, is considered. Non-linear equations for the expected values (flux) are also obtained and solved, the results are compared with the ordinary linear theory, and possible advantages of the new formulation are cited. Generalizations to a large class of transport problems are discussed. The nonlinear time-dependent operator for transport in one dimension is considered in detail. It has a pure point spectrum, and expansion theorems can be proved. These results contrast with those for isotropic one-velocity neutron transport in the infinite slab. Here there are only a finite number of points in the point spectrum, with a half-plane in the continuous spectrum. Approximations to the eigenvalues and eigenfunctions for the slab case, as well as extensions to the multivelocity problem, are mentioned. There is a brief discussion of recent spectral and expansion theorems for very general geometries. (auth)

18478 UCRL-8730

California. Univ., Berkeley. Lawrence Radiation Lab.

SPINS, MOMENTS, AND HYPERFINE STRUCTURES OF SOME BROMINE ISOTOPES (thesis). Thomas Myer

Green, III. June 1959. 111p. Contract W-7405-eng-48. $2.50(OTS).

Results of measurements on a series of bromine isotopes by the method of atomic beams are presented. Experimental techniques, theory, and apparatus employed are described, together with a discussion of the results. Original results presented are:

Br^{82} ($\tau_{1/2}$ = 35.5 hr) I = 5 a = 205.04 ± 0.05 b = −870.66 ± 0.90 Mc

$\Delta\nu_{12}$ = 766.82 ± 0.60; $\Delta\nu_{23}$ = 1287.32 ± 0.43 Mc

$\Delta\nu_{34}$ = 1488.6 ± 1.1 (calc.)

μ(calc.) = 1.624(5) Q(calc.) = 0.76(3)

Br^{80m} (4.5 hr) I = 5

Br^{80} (18m) I = 1

Br^{77} (57 hr) I = 3/2

Br^{76} (17 hr) I = 1 a = 345.417 ± 0.07; b = 314.329 ± 0.11 Mc

$\Delta\nu_{12}$ = 1256.45 ± 0.07; $\Delta\nu_{23}$ = −189.115 ± 0.07 Mc

μ(calc.) = ±0.5480(2) Q(calc.) = ∓0.27(2). (auth)

18479

A POSSIBILITY OF DETERMINING Z WITH THE AID OF δ RAYS. C. Beşliu and M. G. Petraşcu. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 37-45(1959). (In Rumanian)

A new method for the determination of the Z number of light nuclear is established using the density g of δ beams and the residual number of δ rays. From the equation $N/N_0 = (Z^{n+4/n})/(Z_0^{n+4/n})$ where n = 2 or 1.5. The Z number can be determined by knowing between the densities g and g_1 the numbers N and N_0 of the δ rays appearing at the unknown Z track and at the Z_0 standard track. The method is also applicable to tracks which do not stop in the emulsion. The method was verified for six protons and six α particles. It has a precision of 4 to 17%. (tr-auth)

18480

OBTENTION OF A BEAM OF MONOKINETIC PROTONS WITH A VAN DE GRAAFF AND STUDY OF CAPTURE RESONANCES OF PROTONS WITH ENERGY BETWEEN 1 AND 2 Mev BY MAGNESIUM-25 AND MAGNESIUM-26. Robert Barjon. Ann. phys. 4, 545-94(1959) May-June. (In French)

The obtention of a stable proton beam from a Van de Graaff accelerator was investigated. The accelerator used had no stabilization circuits or particle analyzer and had a capillary ion source. A high-frequency ion source, an electrostatic deflector, and stabilization circuits were designed which permitted the obtention of stable 10-μ amp beams with the energy controlled to better than 2 parts per 1000 in the energy range from 0.5 to 2 Mev. The accelerator was used to determine the energy levels of Al^{26} and Al^{27} from the proton capture resonances of Mg^{25} and Mg^{26}. The proton absorption cross sections for Mg^{25} and Mg^{26} were also studied. The results are presented. (J.S.R.)

18481

CONTRIBUTION TO THE STUDY OF THE OPTICAL MODEL OF THE NUCLEUS. Loup Verlet. Ann. phys. 4, 643-87(1959) May-June. (In French)

The optical model is a description of the elastic scattering and the absorption by a schematization of the interaction of the incident nucleon with the particles of the target nuclei by a simple potential. The optical potential is calculated by considering the interaction between the incident nucleon and the target nuclei as a small perturbation. The expression obtained by the perturbation theory for the optical potential is used by including the second-order terms in nucleon-nucleon interaction. This interaction is approximated by regular central potentials which are only valid at low energies. The convergence of the series of perturbations is studied. (J.S.R.)

18482

CONTRIBUTION TO THE STUDY OF THE ROLE OF NON-CENTRAL FORCES IN NUCLEAR STRUCTURE. Bernard Jancovici. Ann. phys. 4, 689-744(1959) May-June. (In French)

Different aspects of the role of non-central forces in the structure of atomic nuclei and the possible relationships between these forces are studied. Two problems of beta radioactivity and their implications on the non-central forces are investigated. The origin of spin-orbital forces is then considered. It is shown that the beta life of C^{14} can be explained by the presence of tensor forces. The same model explains the beta life of O^{14} in its transition to the ground state of N^{14}. The beta life of B^{12} can be explained by the presence of vector forces (spin-orbit). The initial state of B^{12} and the final states of the residual nucleus C^{12} belong in the first approximation to different supermultiplets, between which a β transition would be impossible. The same model is applied qualitatively to Li^8. The wave functions more closely approach LS coupling than j−j coupling. An attempt is made to explain the spin-orbit forces in the complex nucleus as an effect of second order tensor forces. The Thomas-Fermi approximation is used. The Brueckner method is applied to the problem of spin-orbit potential, integrals for a bound nucleon are calculated, and the numerical results are discussed. The theory is extended to polarization of high-energy nucleons. (J.S.R.)

18483

A STUDY OF INTERNAL CONVERSION COEFFICIENTS OF TRANSITIONS IN Pb^{205} AND Pb^{206}. Rune Stockendal and Sölve Hultberg (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 33-48(1959).

Relative intensities of 14 gamma rays following the decay of Bi^{205} and 11 gamma rays from the decay of Bi^{206} were measured by the method of external conversion in uranium. From additional measurements of the internal conversion lines from the same source (or from a source of known relative source strength) the K-conversion coefficients of these gamma transitions were determined absolutely with an accuracy varying between 10 and 50%. The multi-polarity assignments based on these values are in most cases in agreement with those suggested from scintillation spectra and internal conversion-line spectra. Further support of the excited state of 2566.5 kev in Pb^{205} was found from the detection of the K- and L-conversion lines of a 2567.8 ± 2.0 kev transition. The K-conversion line of a 2610.0 ± 2.0 kev gamma ray was detected suggesting an excited state of this energy. (auth)

18484

LIGHT POLONIUM ISOTOPES FROM CARBON ION BOMBARDMENTS OF PLATINUM. Hugo Atterling and

Wilhelm Forsling (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 81-8(1959).

By bombarding platinum with C^{12} and C^{13} ions in the Stockholm 225-cm cyclotron, polonium isotopes of low mass numbers were produced and their alpha-decay properties studied. One of the alpha activities found was assigned to Po^{203} with a particle energy of 5.48 Mev and a half-life of 45 ± 10 minutes. For Po^{202} a half life of 43 minutes was obtained. This is considerably shorter than reported earlier. (auth)

18485

ON THE POSSIBLE EXISTENCE OF A ZERO-SPIN EXCITED STATE IN Ca^{42}. I. Asplund and T. Wiedling (Univ. of Stockholm). Arkiv Fysik 15, 303-6(1959).

The 0.3 Mev–1.5 Mev gamma cascade in Ca^{42} has been investigated by angular correlation measurements. It has been shown that the second excited level is probably a 0+ spin state and that the 0.3 Mev transition has E2 character. (auth)

18486

MEASUREMENTS ON THE RADIATION FROM THE DECAY OF I^{134} AND I^{133}. Goran Holm and Hans Ryde (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 387-96(1959).

The beta and gamma radiations from the radioactive decay of the isotopes I^{134} and I^{133} have been studied by means of magnetic beta spectrometers and scintillation techniques. A Fermi analysis of the beta-ray spectrum from the decay of I^{134} shows that it is very complex. The maximum energy is found to be 2.35 Mev, and the measured energies of two further components are 1.57 and 1.3 Mev. The energies of the gamma rays following the decay of I^{134} are 0.138, 0.21, 0.42, 0.63, 0.86 (there seem to be two gamma rays with about this energy), 1.07, 1.14, 1.45, 1.62, and 1.80 Mev. Coincidence experiments have been carried out, and the beta disintegration energy (Q_β- value) for the decay of I^{134} to Xe^{134} is estimated as 4.1 Mev. As regards the decay of I^{133}, the maximum energy of the beta-ray spectrum is found to be 1.27 Mev. Furthermore, beta components are found having energies of about 0.94 and 0.7 Mev. Gamma rays with the following energies are associated with this decay: 0.35, 0.53, 0.71, 0.87, 1.05, 1.24, and 1.30 Mev. (auth)

18487

NUCLEAR MAGNETIC DIPOLE AND ELECTRIC QUADRUPOLE MOMENTS OF RADIOACTIVE BISMUTH ISOTOPES. I. Lindgren and C. M. Johansson (Univ. of Uppsala). Arkiv Fysik 15, 445-62(1959).

The hyperfine structure of the neutron-deficient bismuth isotopes $Bi^{203-206}$ has been studied by the atomic beam magnetic resonance method by use of six-pole focusing and radioactive detection. The results are tabulated. The magnetic dipole moments (μ_I) are calculated from the magnetic dipole interaction constants (a) by means of the known values of a and μ_I of Bi^{209} and the Fermi-Segrè formula, neglecting the hfs anomaly. In order to obtain the electrical quadrupole moments (Q) from the electric quadrupole interaction constants (b), the intermediate state of bismuth has been determined from the optically measured energy levels and from the known g_J-value of the ground state. The average of the inverse cube of the distance of the electrons from the nucleus, (r^{-3}), has been calculated from the magnetic dipole interaction in Bi^{209} and is compared with the value obtained from the spin-orbit coupling. The quadrupole moments are not corrected for the effect of distortion of the inner electron shells (Sternheimer's correction). The results are compared with theoretical values obtained from the nuclear shell model. Resonance frequencies of the two lines of Bi^{203}, Bi^{204}, and Bi^{206} at different magnetic fields are tabulated and resonance curves given. (auth)

18488

NUCLEAR SPINS OF THE BISMUTH ISOTOPES Bi^{199}, Bi^{200}, Bi^{201}, AND Bi^{202}. S. Axensten, C. M. Johansson, and I. Lindgren (Univ. of Uppsala). Arkiv Fysik 15, 463-9(1959).

The atomic beam magnetic resonance method has been used for measurements of the ground-state spins of four short-lived bismuth isotopes with the following results: for Bi^{199} (25 min) $I = 9/2$, for Bi^{200} (35 min) $I = 7$, for Bi^{201} (1.85 hr) $I = 9/2$, and for Bi^{202} (1.6 hr) $I = 5$. All attempts to find the 1.0 hr isomeric state in Bi^{201} have been unsuccessful. The spin values obtained are discussed from the point of view of the nuclear shell model. (auth)

18489

THE FISSION CROSS-SECTION OF Am^{241} FOR 14.6 Mev NEUTRONS. A. N. Protopopov, Yu. A. Selitskii, and S. M. Solov'ev. Atomnaya Energ. 6, 67-8(1959) Jan. (In Russian)

The cross section for Am^{241} fission by 14.6-Mev neutrons is $\sigma = 2.35 \pm 0.15$ barns. (R.V.J.)

18490

THE SPECIFIC α-ACTIVITY AND HALF-LIFE OF U^{233}. Ya. P. Dokuchayev and I. S. Osipov. Atomnaya Energ. 6, 73(1959) Jan. (In Russian)

The specific α activity of U^{233} was determined for five uranium specimens with isotopic content (in wt. %): $U^{232} \sim 4 \times 10^{-3}$; U^{233}, 93.28 to 95.24; U^{234}, 2.25 to 2.36(±0.07); U^{235}, < 0.1; and U^{238}, 2.46 to 4.38(±0.07). The α activity of the specimens indicated 20,940 α-decay/min per microgram U^{233}. Considering that all specimens had ~0.05 wt. % of practically inactive (in comparison to U^{233}) U^{235} isotope, the U^{233} specific α activity is 20,950 ± 100 α decay/min per μg. (R.V.J.)

18491

THE SPECIFIC α-ACTIVITIES OF Pu^{239} AND Pu^{240}. Ya. P. Dokuchaev. Atomnaya Energ. 6, 74(1959) Jan. (In Russian)

The specific α activities of Pu^{239} and Pu^{240} were determined using twelve specimens with isotopic content: Pu^{239} = 91.26 to 99.11; Pu^{240}, (0.87 ± 0.06) to (7.57 ± 0.1); Pu^{241}, (1.3 ± 0.3) × 10^{-2} to (1.04 ± 0.05); Pu^{238}, (1.62 ± 0.1) × 10^{-3} to (1.75 ± 0.05) × 10^{-2}; and Pu^{242} + Np^{237}, 0.01 to 0.1 (wt. %). Alpha activity per μg of Pu^{239} was 136,200 ± 200 decays per min, corresponding to a half life of 24,390 ± 30 years. For Pu^{240}, 500,000 ± 4000 decays/min/μg, corresponding to a half life of 6,620 ± 50 years. The results are in good agreement with published data. (R.V.J.)

18492

ANISOTROPY OF THE U^{238} FISSION BY 14 Mev NEUTRONS. A. N. Protopopov and V. P. Eismont. Atomnaya Energ. 6, 644-7(1959) June. (In Russian)

A double ionization chamber was used for studying the angular distribution of fragments from U^{238} fission by 14-Mev neutrons. It was found that the angular distribution of heavy and light fragments are symmetric (order of accuracy 3%) to the direction perpendicular to the neutron beam. Moreover, it is shown that the direction of the light and heavy fragment are isotropic

in symmetric and asymmetric fissions. It was also established that with a fragment mass ratio less than 1.7 to 1.8, the angular anisotropy increases with the increase of mass asymmetry. The results are discussed within the limits of the statistical theory of V. M. Strutinskii. (tr-auth)

18493

DIFFERENTIAL CROSS SECTIONS OF 19.6 Mev PROTON ELASTIC SCATTERING ON SEPARATED ISOTOPES. R. A. Vanetsian, A. P. Klyucharev, and E. D. Fedchenko. Atomnaya Energ. 6, 661-3(1959) June.

Measurements were made of the differential elastic scattering cross sections of 19.6-Mev protons on the separated isotopes Cd^{111}, Cd^{113}, Cd^{116}, Co^{59}, Cu^{63}, Cu^{65}, Bi^{203}, Ge^{73}, Ge^{74}, Li^{6}, Li^{7}, Pb^{207}, Pb^{208}, Sn^{116}, Sn^{117}, Sn^{118}, Sn^{119}, Sn^{120}, Sn^{122}, Sn^{124}, and U^{238}. Two photomultipliers with NaI(Tl) crystals were used. A 20-Mev accelerator was used as a proton source. The absolute values were measured in the angular range 20 to 160° with an order of precision of ±5%. The resuls are presented graphically. (R.V.J.)

18494

SPACE AND ENERGY DISTRIBUTION OF NEUTRONS IN BORON CARBIDE. S. P. Belov, V. A. Dulin, Yu. A. Kazanskii, V. I. Kukhtevich, and S. G. Tsypin. Atomnaya Energ. 6, 663-5(1959) June. (In Russian)

Studies were made of the space and energy distributions of 3- to 15-Mev neutrons in boron carbide. Reactions $H^2(H^2,n)He^3$ and $H^2(H^3,n)He^4$ were used as sources for 3-Mev and 15-Mev neutrons, respectively. A proportional counter with BF_3 enriched up to 88%, a fission chamber with U^{235} (enriched up to 75%) and Th^{232}, and threshold indicators of $P^{31}(n,p)Si^{31}$, $Al^{27}(n,p)Mg^{27}$, $Fe^{56}(n,p)Mn^{56}$, $Sb^{121}(n,2n)Sb^{120}$, $Cu^{63}(n,2n)Sb^{120}$, $Cu^{63}(n,2n)Cu^{62}$, and $In^{115}(n,\gamma)I^{116m}$ were used as neutron detectors. The results are plotted and tabulated. The ratio of the U^{235} fission cross section σ_{235} (E_{eff}) to σ_B (E_{eff}) in (n,α) reactions on B^{10}-boron carbide was determined. The ratio of 3-Mev neutron weakening in the region of fixed spectra was 0.97 ± 0.03. The obtained relation was used for finding the effective energy E_{eff} = 120 ± 10 kev. (R.V.J.)

18495

DESTRUCTION OF RADIOACTIVE DECAY BY IRRADIATION. (to Louis Vercharaeghen). German Patent DAS 1 042 780. Nov. 6, 1958. Atompraxis 5, 248(1959) June. (In German)

Radioactive decay was destroyed by exposing the unstable substance to electromagnetic or corpuscular radiation so that the radioactive materials were transformed into stable isotopes or into isotopes with short-lived radioactivity. These isotopes can then be separated by physical, chemical, or physicochemical fractionation from the remaining radioactive material. The irradiation can be done in a reactor or particle accelerator, depending on the nature of the decaying isotope. The transformation can result from fission, fusion, or simple transmutation processes. By this method the dangerous radioisotopes can be eliminated.

18496

EFFECTIVE AND THERMAL NEUTRON CAPTURE CROSS SECTION AND RESONANCE CAPTURE INTEGRAL OF Pr-143. J. C. Roy and L. P. Roy (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 37, 907-15(1959) Aug.

The effective neutron capture cross section, $\hat{\sigma}$, the 2200 meters/sec neutron capture cross section, σ_0, and the resonance capture integral, RI, of Pr^{143} have been measured by an activation method. The values are: $\hat{\sigma}$ = 93 ± 10, σ_0 = 89 ± 10, and RI = 190 ± 25 barns, respectively. The neutron fluxes have been measured with cobalt monitors. All these values have been calculated according to the Westcott convention, which has been outlined insofar as it can be applied to activation work. (auth)

18497

THE CUMULATIVE FISSION YIELDS OF LIGHT MASS FRAGMENTS IN THE THERMAL NEUTRON FISSION OF Pu^{239}. H. R. Fickel and R. H. Tomlinson (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 37, 916-25 (1959) Aug.

The relative cumulative yields of 19 light mass fragments of rubidium, strontium, yttrium, zirconium, molybdenum, and ruthenium formed in the thermal neutron fission of Pu^{239} have been determined with a mass spectrometer using the isotope dilution technique. The yields of the fission product isotopes of these elements, together with the previously published relative yields of three krypton isotopes, have made possible the determination of the absolute yields of 22 light fragment mass chains. (auth)

18498

THE CUMULATIVE FISSION YIELDS OF 21 HEAVY MASS NUCLIDES PRODUCED IN THE THERMAL FISSION OF Pu^{239}. H. R. Fickel and R. H. Tomlinson (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 37, 926-36(1959) Aug.

Mass spectrometric analysis of cesium, barium, cerium, neodymium, and samarium produced in the thermal fission of Pu^{239} has made possible the determination of the cumulative yields of 17 mass chains. With previously published mass spectrometric yields of four xenon isotopes normalized to the present data a total of 21 cumulative yields are reported. (auth)

18499

ON THE SPHERICAL OSCILLATOR NUCLEUS. T. D. Newton (Atomic Energy Canada, Ltd., Chalk River, Ont., Can.). Can. J. Phys. 37, 944-64(1959) Aug.

The degree of consistency of an oscillator model of a nucleus is examined by means of a type of Hartree–Fock calculation based on a simple form of internucleon potential valid at low energies. An effective mass equal to 0.757 times the mass of a free nucleon is used. The oscillator wave functions are found to be not far from self-consistent and the oscillator frequency derived is physically reasonable, but the bound on the binding energy is not good. It is also shown that the oscillator wave functions are a good approximation for the state functions of particles bound in a finite potential well having the shape of a cutoff oscillator so that the Hartree–Fock calculation can be used to prescribe a shell model potential. (auth)

18500

A METHOD FOR STUDY OF THE ELECTROMAGNETIC PROPERTIES OF CHARGED π MESONS. Lazare Goldzahl, Bernard Jouvet, Maurice Mathieu, and Jacques Poyen (Collège de France, Paris). Compt. rend. 249, 88-90(1959) July 6. (In French)

The possibility of studying the electromagnetic structure of π mesons by observing the electrons projected by them is investigated. These experiments led to a new method of determining the spin of the π meson. (tr-auth)

18501

TRANSITORY PHENOMENA AND NUCLEAR RELAXATION OF OPTICALLY ORIENTED Hg^{199}. Bernard Cagnac and Jean Brossel. Compt. rend. 249, 253-5 (1959) July 15. (In French)

The transitory phenomena for establishment of the nuclear orientation of Hg^{199} permit measurement of the longitudinal relaxation time. The "nutation" of the nuclear spins of Hg^{199} is also observed optically in a magnetic resonance. The transversal relaxation time is then deduced. (tr-auth)

18502

ELECTRON EMISSION FROM THE SURFACE OF PURE MOLYBDENUM AFTER BOMBARDMENT BY ELECTRONS. M. V. Sinel'nikov (Moscow Inst. of Engineering Physics). Doklady Akad. Nauk S.S.S.R. 126, 554-6(1959) May 21. (In Russian)

Electron emission from the surface of pure Mo was studied at room temperature, in darkness, and in the absence of electric fields. Emissions of high-energy particles from the surface were observed following irradiation by a weak electron flux. Further studies of the properties of such emissions from other pure metals are in progress. (R.V.J.)

18503

FISSION OF Th^{232} NUCLEI BY NEGATIVE μ- AND π-MESONS. M. G. Petrashku and A. K. Mikhul (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 126, 752-4(1959) June 1. (In Russian)

Heavy nuclei fission by μ^- mesons is possible through nuclear excitation in the μ^- optic transition 2p−1s in a mesoatom. Fission occurs when the transition exceeds the photoproduction threshold and when mesons are absorbed by nucleons in reactions such as $\mu^- + p \rightarrow n + \nu$. The possibility of non-radiative excitation of nuclei according to the first type of event, with γ emission in the radiation transition followed by nuclear excitation, was observed previously. An attempt is made to obtain data on the non-radiative fission of thorium. In addition to studies of thorium fission by μ^-, studies are made of fission in π^- capture; in evaluating the probability of the first process it is imperative to know the effect of π^- capture, as the μ^- beam is not pure. Some 11,075 π^- capture events were observed, and the star distribution was compared with previously reported data. It was determined that the μ^- contribution was about 15%. Consequently, of the observed 11,075 captures 9400 are related to π^- mesons. In 17 fissions in the same area, ~0.5 events were related to μ^-. Hence, the probability $P(\pi^-)$ in which the π^- capture can initiate fission is equal to $(1.8 + 0.4) \times 10^{-3}$. Capture events totaling 11,270 were observed in plates irradiated by μ^- containing $0.2 \pm 0.1\%$ π^-. It was assumed that not more than 0.1% fissions result from π^- capture. The probability $P(\mu)$ with which μ^- induces fission is $(2.7 \pm 17) \times 10^{-4}$. The results confirm that there is slight probability of catalytic thorium fission by μ^- through non-radiative capture. The evaluation of the internal conversion probability showed one catalytic fission event requires nearly 300 μ^- captures. (R.V.J.)

18504

THE MECHANISM OF NUCLEAR REACTIONS. U. Facchini (Università, Turin and CISE, Milan). Energia nucleare (Milan) 6, 441-57(1959) July. (In Italian)

The work done in recent years on the mechanism of nuclear reactions and on the structure of the nucleus is briefly reviewed. Reactions at low and medium energies with heavy and medium nuclei are discussed. 38 references. (J.S.R.)

18505

ENERGY DISTRIBUTION OF NEUTRONS FROM Ra-D-Be SOURCE. B. Sen (Saha Inst. of Nuclear Physics, Calcutta). Indian J. Phys. 33, 158-64(1959) Apr.

The energy distribution of neutrons from RaD−Be source has been studied with photographic plates. The effect of scattering of these neutrons in lead was investigated also. The neutron peaks in the energy distribution curve correspond to different levels of C^{12}. The discrepancies are discussed. (auth)

18506

ELASTIC SCATTERING AND POLARIZATION OF 300 Mev PROTONS. Arundhati Ghosh (Indian Assoc. for the Cultivation of Science, Calcutta). Indian J. Phys. 33, 197-200(1959) May.

Analysis of elastic scattering and polarization of 300-Mev protons is made in Born approximation for Woods-Saxon type of nucleon-nuclear potential with spin-orbit coupling. (auth)

18507

POLARIZATION OF NUCLEONS DUE TO ANOMALOUS MAGNETIC MOMENT IN HIGHER BORN APPROXIMATION. S. Sarkar (Indian Assoc. for the Cultivation of Science, Calcutta). Indian J. Phys. 33, 213-20(1959) May.

An extension was made of Schwinger's calculation on polarization of neutrons up to the second Born approximation taking non-relativistic form of the interaction of spin orbit coupling. Considering the corresponding invariant interaction of the form $F_{\mu\nu}\,\gamma_\mu\,\gamma_\nu$, the expression was calculated for the polarization of the scattered particles in first-order relativistic Born approximation. This result agrees with Wolfenstein's expression except for the characteristic Coulomb phase factor. An attempt was made to calculate the corresponding second-order relativistic Born approximation. (auth)

18508

STUDY OF ISOTROPIC NEUTRON DIFFUSION. P. Lafore and J.-P. Millot. Inds. atomiques 3, No. 5-6, 66-8(1959). (In French)

The diffusion of neutrons is treated mathematically taking into consideration a finite number of energy groups and assuming that at each collision the neutrons either change groups or remain in the same group. The calculation is interesting for the case where one obtains an equilibrium spectrum. This is the particular case of a multiplying medium or the case of thermal neutrons in a medium at a given temperature. The calculation is applied to the Milne problem and extended to the case where the total cross section is different for each energy group. (T.R.H.)

18509

^{115}Cd ISOMER YIELD RATIOS FROM DEUTERON FISSION OF ^{238}U AND FROM THE $^{118}Sn(d,\alpha p)$, $^{118}Sn(n,\alpha)$, $^{115}In(d,2p)$, $^{115}In(n,p)$, AND $^{114}Cd(d,p)$ REACTIONS FROM 10 TO 25 Mev. R. A. Sharp and A. C. Pappas (Univ. of Oslo). J. Inorg. & Nuclear Chem. 10, 173-82(1959) May.

The isomer yield ratio of $Cd^{115m}(11/2-)$ to Cd^{115} $(1/2+)$ has been investigated for the reactions $U^{238}(d,f)$, Sn^{118} $(d,\alpha p)$ and (n,α), $In^{115}(d,2p)$ and (n,p), and $Cd^{114}(d,p)$ from 10 to 25 Mev. The results are discussed in terms of several spin important mechanisms. The minimum in

the isomer yield ratio vs. energy for $U^{238}(d,f)$ is consistent with a proposal involving increased fission barrier penetration for high-spin compound nuclei in symmetric fission at low excitation energies. (auth)

18510

RADIATIONS OF ^{93}Y AND ^{94}Y AND HALF-LIVES OF ^{93}Sr AND ^{94}Sr. J. D. Knight, D. C. Hoffman, B. J. Dropesky, and D. L. Frasco (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 10, 183-97 (1959) May.

The radiations of Y^{93} and Y^{94} have been examined by β-ray spectrometry and γ-ray scintillation spectrometry. Y^{93} decays about 90 per cent by a 2.89 ± 0.02-Mev β transition to the ground state of Zr^{93}; the spectrum of the 2.89 Mev group has a unique first-forbidden shape. Gamma rays of energies 0.267, 0.49, 0.665, 0.935, 1.15, 1.20, 1.42, 1.89 to 1.91, 2.14 to 2.18, and ~2.43 Mev accompany the remaining 10 per cent of the disintegrations. On the basis of γ-γ coincidence measurements, these radiations have been fitted to a partial decay scheme involving levels in Zr^{93} at 0.267, 0.935, 1.42, 1.89, 2.18, and ~2.43 Mev. Y^{94} has a complex β spectrum of maximum energy 5.0 ± 0.2 Mev; the highest-energy group corresponds to the transition to the ground state of Zr^{94}. The lower-energy β transitions are accompanied by γ rays of energies of 0.56, 0.92, 1.13, 1.65, 1.90, 2.13, 2.84, and 3.53 Mev, plus unresolved γ-ray groups at 2.57 and 3.06 Mev. The half lives of Sr^{93} and Sr^{94}, measured by experiments involving periodic chemical separations of Y^{93} and Y^{94} from fission-product strontium, are 8.2 ± 0.8 min and 1.3 ± 0.2 min, respectively. The half lives of Y^{93} and Y^{94} are 10.25 ± 0.10 hr and 20 ± 1 min, respectively. A search has been made for isomerism in Y^{93}. Measurements on yttrium grown from fission-product strontium have shown no definite evidence for an isomer of Y^{93} with a half life in the range 30 sec to 3 hr. The yield of 10.25 hr Y^{93} from fission of U^{235} by water-moderated "pile" neutrons is (6.1 ± 0.6) per cent. (auth)

18511

γ-RAYS FOLLOWING THE β-DECAY OF RARE-EARTH α-EMITTERS. K. S. Toth and J. O. Rasmussen (Univ. of California, Berkeley). J. Inorg. & Nuclear Chem. 10, 198-204(1959) May.

The β-decay properties of the rare-earth α emitters, Dy^{150}, Dy^{151}, Dy^{152}, and Tb^{149}, are discussed. By bombardment of stable praseodymium with N^{14} ions at different energies in the Berkeley heavy-ion linear accelerator, the three dysprosium isotopes have been produced. Gamma-spectra have been obtained, and the following γ rays have been assigned to the decay of the three nuclides; 390 kev (Dy^{150}), 145 kev (Dy^{151}), and 255 kev (Dy^{152}). Annihilation peaks have been observed to decay with the half lives of the three isotopes, indicating that the nuclides must emit positrons. In addition, the mass assignments of Dy^{150} and Dy^{151}, the 8 min and 19 min dysprosium α emitters respectively, have been determined with certainty. Tb^{149} has been produced by bombarding stable praseodymium with C^{12} ions. The energies of the γ rays following the decay of Tb^{149} are 170, 230, 360, and 640 kev. (auth)

18512

STUDY OF THE Be (n, 2n) 2α REACTION. M. Cao Xuan Chuan. J. phys. radium 20, 621-3(1959) June. (In French)

The Be (n, 2n) 2α reaction has been investigated by incorporating Be^9 in nuclear plates. These plates are irradiated with 14-Mev neutrons. The observation of the two resulting alphas provides a means of investigating the excited levels of Be^8; it seems that the reaction goes mostly through the 2.9-Mev excited level of Be^8. The cross section is estimated to 470 mb with 30% precision. Search for the possibility of emission of a "di-neutron" gives a negative result. (auth)

18513

STUDY OF THE ELECTRONS AND AUTOIONIZATION X RAYS EMITTED SIMULTANEOUSLY WITH THE β RADIATION OF PROMETHIUM-147. F. Suzor and G. Charpak. J. phys. radium 20, 647-8(1959) June. (In French)

With 2 proportional counters in coincidence, a study has been of the low-energy photon and electron spectrum in Pm^{147}. The intensity of the autoionization L x ray is found to be $(3.2 \pm 0.2) \times 10^{-4}$. The electron spectrum emitted simultaneously with the β spectrum, in strong disagreement with theory, is found to reach 160×10^{-4} between 1 and 5 kev and 50×10^{-4} between 5 and 20 kev. (auth)

18514

ELASTIC AND INELASTIC SCATTERINGS OF PROTONS FROM Ti, Cr, Ni, Zn, AND O AT 8 TO 14 Mev. Chuin Hu, Yukiyasu Oda, Minoru Takeda, and Takashi Yamazaki (Osaka Univ.); Ken Kikuchi (Univ. of Minnesota, Minneapolis); Shinsaku Kobayashi and Kazuhisa Matsuda (Univ. of Tokyo); Yukio Nagahara (Yokohama National Univ., Japan); and Naoyuki Takano (Kyushu Univ., Japan). J. Phys. Soc. Japan 14, 861-9(1959) July.

The elastic and inelastic (leading to the first excited states of target nuclei) scattering of protons by medium weight nuclei (Ti, Cr, Ni, and Zn) was studied by observing the dependence of their angular distributions on bombarding energies from 8 to 14 Mev. The angular distributions of protons elastically scattered from oxygen were also measured in the same energy range. There are appreciable regularities in the elastic scattering by medium weight nuclei as regards the dependence of their angular distributions on the bombarding energy and on the atomic number except in the case of the bombarding energy of 8 Mev. The elastic scattering from oxygen shows an anomalous behavior at energies about 9 Mev. The angular distributions of protons inelastically scattered from medium weight nuclei can be fitted by the predictions of the direct interaction theory with Born approximation at about 14 Mev, but at the lower bombarding energies they seem not to do so, although they have the prominent forward peaks. The distorted Born approximation or the admixture of amplitudes due to compound process seems to be necessary to explain the angular distributions. In addition, it is found that the yield of the inelastic scattering varies with the bombarding energy appreciably. For Ni target, the dependence of the yield of the inelastic scattering leading to the first excited state on the bombarding energy was measured in detail by changing the incident proton energy finely at intervals of about 50 kev. It was recognized that there were resonance-like behavior with spacing of about several hundred kev. (auth)

18515

$C^{12}(n,n')3\alpha$ REACTION INDUCED BY 14.8 Mev NEUTRONS. Yoshikazu Tsuneoka (Univ. of Kyoto). J. Phys. Soc. Japan 14, 869-79(1959) July.

The probable mechanism of the $C^{12}(n,n')3\alpha$ reaction

when induced by d-T neutrons has been deduced from a study of 403 stars in nuclear emulsions. The angular distribution of the inelastically scattered neutrons show a forward peak, and it is concluded that the reaction occurred mainly through the compound nucleus and that the asymmetry at about 90° is caused by the interference of several levels. The possible decay mode of the C^{12} nucleus was also investigated, and an approximate branching ratio was obtained, assuming that the decay mode via Be^{9} was negligible. Then, comparing the angular distributions of the inelastically scattered neutrons which correspond to the different decay modes, Sacks's model for the direct break-up of C^{13*} was found to be in disagreement with the present experimental results. (auth)

18516

SOME NEW ASPECTS OF THE PRODUCTION OF RADIOISOTOPES POSSESSING HIGH SPECIFIC ACTIVITY WITH THE AID OF HOT ATOM CHEMICAL PROCESSES ACCOMPANYING THE NUCLEAR REACTION (n,γ). Kristian Svoboda (Biofysikální ústav ČSAV, Brno). Jaderná energie 5, 157-60(1959). (In Czech.)

The production of radioisotopes by the (n,γ) reaction is very cheap and often used. The problem of separating the activated radioisotopes from the great bulk of the inactive mother element has been solved by the method of Szilard and Chalmers. The application of this method, however, is in many cases impossible because of the unfavorable value of the exchange velocities of radioisotope and mother element compounds. The task was to examine the quantitative influence of exchange reactions on the yields of the Szilard-Chalmers method. If the product of the mother element concentration and of the exchange constant is greater than $10^2\ \lambda$, it is impossible to get a reasonable yield when using the hitherto static method of the Szilard-Chalmers process. With recourse to the results of mathematical analysis it was possible to work out a new dynamic method. Its principle consists of the simultaneous activation and extraction of the mother compound. In this way it is possible to overcome the unfavorable influence of the exchange reactions on the Szilard-Chalmers process. (auth)

18517

THEORY OF RADIATIVE CAPTURE REACTIONS. A. M. Lane (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 11, 625-45(1959) June (2).

Starting from an exact dispersion theory, it is shown how cross sections for capture by various mechanisms may be extracted by appropriate specializations of the theory. The cross section for "compound nucleus" capture is derived by the usual assumption of random signs for matrix elements (reduced width amplitudes). It is pointed out that this cross section reduces to the Weisskopf-Ewing formula that is commonly used only after a second assumption is made, viz., that the density of energy levels of spin I in the final nucleus is proportional to (2I + 1). The cross section for "direct" capture, which has previously been derived phenomenologically, is extracted from the exact formalism by techniques developed by Bloch and by Brown and de Dominicis for treating other kinds of direct reactions. Attention is drawn to the fact that the integrals in the matrix elements of the electromagnetic interaction should be taken to infinity, thereby incorporating a contribution from the channels besides the usual one from the nuclear interior. This channel contribution is shown to be very important in practice. (auth)

18518

ANALYSIS OF EXPERIMENTAL DATA ON NUCLEON CAPTURE REACTIONS. A. M. Lane and J. E. Lynn (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 11, 646-69(1959) June (2).

Estimates are made of capture cross sections with emphasis on those for capture of 14-Mev neutrons by heavy elements. It is found that the compound nucleus mechanism for capture predicts values several orders of magnitude less than those observed, even after account is taken of the important "photon cascade" contribution. The correct explanation of the data appears to be the "direct" mechanism, which gives order-of-magnitude agreement. Investigation of the structure of the direct E1 integrals shows that the contributions from inside the nucleus are dominated by those from outside. This suggests that direct capture is a "channel" phenomenon, not directly related to the optical model. The same appears to be true of the direct component of photonuclear cross sections. (auth)

18519

A REMARK ON THE QUADRUPOLE INTERACTION ENERGY IN μ MESON ATOMS. J. Von Behr and H. Marschall (Universität, Freiburg i. Br.). Nuclear Phys. 11, 670-4(1959) June (2). (In German)

The calculation of the influence of a deformed nucleus on the fine structure of meson-atomic spectra requires a model of the charge distribution. The usual model involves an additional surface charge on a spherical nucleus. A more realistic but still simplified model represents the nucleus as a spheroid with constant charge density. It is pointed out that the differences between the two models are of the same order of magnitude as the relativistic corrections of the quadrupole-energy. (auth)

18520

E2—M1 MIXING RATIOS IN $2' \rightarrow 2 \rightarrow 0$ TRANSITIONS. S. S. Malik, V. R. Potnis, and C. E. Mandeville (Franklin Inst., Swarthmore, Penna.). Nuclear Phys. 11, 691-5 (1959) June (2).

The results of twelve published angular correlation experiments have been analyzed, and the E2—M1 mixing ratios of the $2' \rightarrow 2$ transitions have been obtained for twelve different even nuclei. Particular attention has been given to evaluation of the errors in the measured values of the mixing ratios. The available data range from A = 56 to A = 198. When $(\delta/E_\gamma)^2$ is plotted against $Z^2A^{\frac{1}{3}}$, three of the experimentally observed points, those for Fe^{56}, Zr^{92}, and Hg^{198}, deviate sharply from a curve calculated from the theoretical considerations of Davydov and Filippov. (auth)

18521

ANGULAR DISTRIBUTIONS FOR ELASTIC AND INELASTIC SCATTERING OF 40-Mev ALPHA PARTICLES BY CARBON, NITROGEN, OXYGEN, AND ARGON. A. I. Yavin and G. W. Farwell (Univ. of Washington, Seattle). Nuclear Phys. 12, 1-34(1959) June (3).

Angular distributions for elastic and inelastic scattering of 40-Mev alpha particles by carbon, nitrogen, oxygen, and argon were obtained. Gas targets were used. Angles of observation ranged from 7° to 130° (laboratory) for carbon and over lesser intervals for the other elements. Elastic scattering angular distributions are characterized by sharply defined diffraction-like structure at the forward angles with maxima and minima

spaced very regularly in $\sin^{1}\!/_{2}\theta$ (c.m.), deep minima near 90° (c.m.), and appreciable cross-sections at angles beyond 90°. A black nucleus diffraction interpretation gives reasonable absolute cross sections for the forward maxima and good agreement with observed locations of maxima and minima. Inelastic scattering angular distributions were obtained for C^{12}(Q = −4.43, −7.65, and −9.61 Mev); for O^{16} [Q = −6.06 and −6.14 Mev (unresolved), −6.91 and −7.12 Mev (unresolved)]; and Ar^{40} (Q = −1.462 Mev). Direct interaction analysis verifies previously assigned spins and parities and indicates an assignment of 0^+ or 2^+ to the 9.61-Mev level of C^{12}. Integrated cross sections for inelastic scattering to individual levels may be as high as 6 per cent of πR^2. Interaction radii determined from diffraction analysis of the elastic scattering data are (in units of 10^{-13} cm) 5.11 ± 0.20 for C^{12}, 5.37 ± 0.17 for N^{14}, 5.64 ± 0.29 for O^{16}, and 6.38 ± 0.32 for Ar^{40}. Interaction radii calculated from inelastic scattering data are consistently larger. Compound nucleus contributions to observed cross sections appear to be small or zero. (auth)

18522

RELATIVE TRANSITION PROBABILITIES BETWEEN ROTATIONAL LEVELS OF NON-AXIAL NUCLEI. A. S. Davydov and V. S. Rostovsky (Moscow State Univ.). Nuclear Phys. 12, 58-68(1959) June (3).

Energies and wave functions are calculated for the rotational states (J = 4, 6, 8) of non-axial nuclei. Relative reduced E2 transition probabilities for the rotational band levels of such nuclei are derived. Conditions under which the rotational states can be characterized by quantum numbers K are established. It is shown that if the nuclear shape differs from axial symmetry, the 1:3.3:7:12 interval rule observed in rotational bands of axial nuclei is violated. The theory is compared with the experimental data. (auth)

18523

A NOTE ON THE INELASTIC SCATTERING OF HIGH ENERGY PROTONS BY LIGHT NUCLEI. L. Egardt (Univ. of Uppsala). Nuclear Phys. 12, 84-6(1959) June (3).

The polarization for the inelastic scattering of 180-Mev protons by B^{11} is calculated using shell-model wave-functions in the L-S coupling extreme. Some discussion is given of the first 0^+-states in C^{12} and O^{16}. (auth)

18524

A NEW TERBIUM ISOTOPE OF MASS 152, AN ALPHA EMITTER. J. Olkowsky, I. Gratot, M. Le Pape, and L. Cohen (C.E.N., Saclay, France). Nuclear Phys. 12, 159-66(1959) July (1).

A new isotope of terbium has been produced by $Eu^{151}(\alpha,3n)$ and $Gd^{152}(p,n)$ reactions. Its half life is found to be 4 ± 0.5 minutes. This isotope decays by electron capture, β^+, and α rays. The ratio α/X_K is $\approx 2 \times 10^{-5}$. Gamma rays of 140 kev and 235 kev are observed. (auth)

18525

ENERGY DEPENDENCE OF THE (p,n) REACTION NEAR A = 70. G. A. Jones (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 12, 167-81(1959) July (1).

Measurements on the energy dependence of the (p,n) reaction for elements near the size resonance in the proton strength function have been made. It is shown that the (p,n) reaction is not always a good measure of the total reaction cross section. The measurements made confirm that the size resonance is for s-wave protons and that a radius $R = 1.45\ A^{1/3} \times 10^{-13}$ cm is suitable for computation of barrier penetrabilities; if a rounded potential well is used to represent the nuclear interaction, they limit the variation of parameters used in the description of the well. (auth)

18526

THE LEVEL SCHEME OF ^{136}Ba. R. K. Girgis and R. Van Lieshout (Instituut voor kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 12, 204-17(1959) July (1).

The gamma radiation following the decay of Cs^{136} was investigated using a scintillation spectrometer. The energies of the various gamma rays are in good agreement with the values reported by Olsen and O'Kelley; the relative intensities were also determined. Gamma-gamma coincidences were performed using a conventional fast-slow coincidence set-up; they were also studied by the summing technique. A decay scheme consistent with these results is proposed. It consists of levels at 830, 1900, 2090, 2170, 2240, 2330, 2430, and 2490 kev. The decay of La^{136}, which also leads to levels in Ba^{136}, was investigated. Only one gamma ray of 830 kev was found with certainty, thus confirming that the first 2^+ level in Ba^{136} has this energy. (auth)

18527

EFFECT OF (n, 2n) AND (n, α) REACTIONS ON AGE CALCULATIONS FOR BERYLLIUM. D. Meneghetti and H. H. Hummel (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 6, 57-62(1959) July.

The effect of incorporating the (n, 2n) and (n, α) reactions into Fermi age calculations for beryllium has been studied. If one neglects these effects an age to 1.44 ev of 85 cm^2 is computed, including a first-flight correction of 4 cm^2, as compared to the experimental value of 80 ± 2. Inclusion of (n, 2n) and (n, α) reactions lowers the calculated age to 71 cm^2. (auth)

18528

SCATTERING AND THERMALIZATION OF NEUTRONS BY BOUND NUCLEI. Jerzy A. Janik (Instytut Badań Jądrowych PAN, Krakow). Nukleonika 4, 241-52(1959). (In Polish)

The problem of inelastic scattering and thermalization of neutrons in polycrystalline moderators is briefly discussed. Detailed discussion is given for the case of hydrogen-containing moderators. In particular, experimentally obtained cross sections and ξ-parameter values as a function of neutron energy are compared with the theory for various moderators. (auth)

18529

NOTE ON THE ELECTRIC QUADRUPOLE ABSORPTION IN THE NUCLEAR PHOTO-REACTION. S. Fujii (Nihon Univ., Tokyo) and O. Sugimoto (Hiroshima Univ.). Nuovo cimento (10) 12, 513-22(1959) June 16.

The behavior of the EQ absorption cross section in the giant resonance region is discussed through the analysis of the angular distributions of emitted particles by using the direct interaction model. The difference between proton's and neutron's angular distributions is attributed to the difference between the effective charges of the proton and the neutron for EQ radiation. The excitation functions for the EQ absorption are computed for $Ar^{40}(\gamma p)Cl^{39}$ and $Co^{59}(\gamma p)Fe^{58}$. It is pointed out that the integrated cross sections for the EQ absorption are favorable to explain the feature of the angular distributions and the excitation curves have a peak near the maximum energy of the giant resonance. The agreement between the results and the experiments for the

angular distributions of the above reactions is good in part. On the whole, however, the ratio of the ED to the EQ absorption cross section is too small in comparison to that required from the experiments. The results of this model are discussed, and the direction of the modification is also indicated. (auth)

18530

OBSERVATIONS OF HYPERFRAGMENTS. F. Breivik, O. Skjeggestad, and S. O. Sörensen (Univ. of Oslo) and A. Solheim (Norwegian Inst. of Tech., Trondheim, Norway). Nuovo cimento (10) 12, 531-40(1959) June 16.

The disintegration of 23 hypernuclei is described, involving 7 mesonic and 16 nonmesonic decays. An event is observed which possibly represents the mesonic decay of a He^6_Λ hypernucleus according to the scheme $He^6_\Lambda \rightarrow He^4 + H^2 + \pi^-$ with $B_\Lambda(He^6_\Lambda) = (3.8 \pm 0.7)$ Mev. (auth)

18531

AN ANALYSIS OF HYPERFRAGMENTS ORIGINATED IN K^--STARS. S. Mora and I. Ortalli (Università, Parma, Italy). Nuovo cimento (10) 12, 635-8(1959) June 16.

A short description of 17 mesonic hyperfragments originating in K^- stars is given. (C.J.G.)

18532

PRELIMINARY RESULTS REGARDING HIGH ENERGY INTERACTIONS OF π^- IN A He-BUBBLE CHAMBER. M. Block, B. Brucker, C. Chang, T. KiKuchi, and C. Meltzer (Duke Univ., Durham, N. C.); F. Anderson and A. Pevsner (Johns Hopkins Univ., Baltimore); H. Cohn (Oak Ridge National Lab., Tenn); E. Harth and J. Leitner (Syracuse Univ., N. Y.); and G. Brautti, C. Franzinetti and R. Tosi (Università, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuovo Cimento (10) 12, 642-3(1959) June 16.

The total number of interactions was 1340, which gave a value for total cross section of 110 mb. Cross section for elastic interaction was about 5 mb. A nuclear radius for He was estimated to be $\sim 2 \times 10^{-13}$ cm. (C.J.G.)

18533

CROSS SECTIONS FOR THE $Li^7(n,\gamma)Li^8$ REACTION. W. L. Imhof, R. G. Johnson, F. J. Vaughn, and M. Walt (Lockheed Missile Systems Div. Research Lab., Palo Alto, Calif.). Phys. Rev. 114, 1037-9(1959) May 15.

The neutron radiative capture cross section of Li^7 was measured for neutron energies between 40 and 1000 kev and at thermal energy. The reaction was detected by observing the beta decay of Li^8 in a natural LiI crystal exposed to a flux of monoenergetic neutrons. The cross sections for the $Li^7(n,\gamma)Li^8$ reaction were obtained relative to the known cross sections for the $Li^6(n,t)He^4$ and the $I^{127}(n,\gamma)I^{128}$ reactions which also took place in the crystal. The $Li^7(n,\gamma)$ cross section decreases from a value of 50×10^{-6} barn at 40 kev to 5×10^{-6} barn at 1000 kev. A maximum in the cross section was found at 250 kev, corresponding to a known level in Li^8 at 2.28 Mev. The observed radiation width of this level was 0.07 ± 0.03 ev. (auth)

18534

STUDY OF SOME LEVELS OF C^{12} USING THE $B^{10}(He^3,p)C^{12}$ REACTIONS. E. Almqvist, D. A. Bromley, A. J. Ferguson, H. E. Gove, and A. E. Litherland (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 114, 1040-53(1959) May 15.

Studies of the $B^{10}(He^3,p)C^{12*}$ reaction using 2-Mev He^3 ions showed proton groups corresponding to levels in C^{12} at 0, 4.43, 7.65, 9.60, 10.76, 11.82, 12.78, 13.37, 14.03, 15.10, 16.10, and 16.64 Mev ± 0.10 Mev. The ratio $\Gamma\gamma:\Gamma$ was measured to be 0.75 (±0.20) for the 15.1-Mev state and 0.02 (±0.01) for the 12.78-Mev state. No other alpha unstable level had a measurable $\Gamma\gamma:\Gamma$; for the 7.65-Mev state a limit 0.01 is set on this ratio. The gamma-ray de-excitation of the 15.1-Mev state is both to the ground state (97%) and to the 4.43-Mev state (3.1 ± 0.6%). Only a ground state transition was observed from the 12.78-Mev level. These measurements support assignments, J, π, T of 1, +, 1 to the 15.1 level and 1, +, 0 to the 12.78-Mev state. The known properties of C^{12} are in fair agreement with the intermediate coupling shell-model calculations of Kurath. The reactions $C^{13}(He^3,\alpha\gamma)C^{12}$(15.1 Mev) and $B^{10}(He^3,d)C^{11}$ to the ground and first excited state of C^{11} were observed. (auth)

18535

ELASTIC SCATTERING OF DEUTERONS FROM Mg, Al, Ti, V, Cr, Co, Ni, and Cu. I. Slaus and W. Parker Alford (Univ. of Rochester, N. Y.). Phys. Rev. 114, 1054-60(1959) May 15.

Angular distributions of deuterons elastically scattered from Mg, Al, Ti, V, Cr, Co, Ni, and Cu have been measured at laboratory energies of 3.32 and 4.07 Mev. The measured cross sections show a smooth decrease below the Rutherford cross section for scattering angles greater than some critical angle which increases with increasing A and decreasing deuteron energy. Cross sections calculated with an optical model show satisfactory agreement with the measurements. The dominant feature of the model is the large imaginary part of the potential, implying strong absorption of deuterons interacting with the nucleus. From the measurements, however, it does not appear possible to identify the reaction mechanism giving rise to this absorption. (auth)

18536

DIRECT RADIATIVE CAPTURE OF PROTONS BY O^{16} AND Ne^{20}. Neil Tanner (California Inst. of Tech., Pasadena and Carnegie Inst. of Washington, D. C.). Phys. Rev. 114, 1060-4(1959) May 15.

A study has been made of the $O^{16}(p,\gamma)F^{17}$ and $Ne^{20}(p,\gamma)Na^{21}$ reactions by counting the positron activities of F^{17} and Na^{21} following proton bombardment of oxygen and neon targets. The $O^{16}(p,\gamma)F^{17}$ cross section was measured at a proton bombarding energy of 616 kev to be 0.29 ± 0.03 microbarn and the $Ne^{20}(p,\gamma)Na^{21}$ cross section was measured at 1100 kev to be 1.3 ± 0.7 microbarns. These cross sections are consistent with the reaction process in each case being one of direct radiative capture. In addition, the energy dependence of the $O^{16}(p,\gamma)F^{17}$ cross section from 275 kev to 616 kev was also consistent with the direct-capture hypothesis. Both of these reactions are believed to be important at the thermal energies effective in stars. For such energies the cross-section parameter S_0 was estimated to be $S_0 = 5 \pm 1$ kev-barns for $O^{16}(p,\gamma)F^{17}$, and $S_0 \sim 80$ kev-barns for $Ne^{20}(p,\gamma)Na^{21}$. (auth)

18537

γ RAYS FOLLOWING THERMAL NEUTRON CAPTURE IN TITANIUM. J. W. Knowles, G. Manning, G. A. Bartholomew, and P. J. Campion (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 114, 1065-74(1959) May 15.

The γ rays following thermal neutron capture in titanium have been studied with two high resolution spectrometers and with an angular correlation arrangement using two sodium iodide scintillation spectrometers. The high resolution instruments were a pair spectrometer for the energy range 2.8 to 11.0 Mev and a double

flat crystal diffraction spectrometer for the energy range 0.14 to 5 Mev. A total of 54 γ rays were observed, 25 of which had not previously been resolved. A decay scheme for Ti^{49} is given with energy levels at 1.378 ± 0.001, 1.583 ± 0.001, 1.719 ± 0.001, 3.172 ± 0.002, and 3.261 ± 0.005 Mev. The neutron binding energy of Ti^{49} is concluded to be 8.132 ± 0.006 Mev. Angular correlation measurements were made between some of the prominent γ rays emitted in the decay of Ti^{49}. The measurements confirm that the spins of the 1.378 and 1.719 Mev levels are $\frac{3}{2}$ and $\frac{1}{2}$, respectively. (auth)

18538

γ-TRANSITIONS BETWEEN CORRESPONDING STATES IN MIRROR NUCLEI. G. Morpurgo (Universita, Parma, Italy and Istituto Nazionale di Fisica Nucleare, Frascati, Italy). Phys. Rev. 114, 1075-80(1959) May 15.

It is shown that charge independence or charge symmetry give rise to the following relations connecting the strengths of γ-transitions between corresponding states in mirror nuclei: (a) the strengths of corresponding E1 transitions are always equal; (b) the strengths of corresponding M1 transitions should not differ in general by more than a factor 1.5; (c) for transitions with $|\Delta T| = 1$ the strengths of corresponding transitions of any multipolarity are equal. The effects of the Coulomb and exchange corrections to the above rules are examined. The experimental data presently available are discussed. (auth)

18539

NUCLEAR SPECTROSCOPY OF ODD-MASS (161-173) NUCLIDES PRODUCED BY PROTON IRRADIATION OF Er AND Yb. B. Harmatz and T. H. Handley (Oak Ridge National Lab., Tenn.) and J. W. Mihelich (Univ. of Notre Dame, Ind.). Phys. Rev. 114, 1082-94(1959) May 15.

To study the effect of nucleon number on nuclear levels of odd-mass rare-earth isotopes, enriched isotopes of Er and Yb were irradiated with protons in the ORNL 86-inch Cyclotron. After chemical separation, the decay chains leading to stable isotopes were analyzed with internal-conversion, photographic-recording, permanent-magnet spectrographs. Precise energy values as well as photometrically measured intensities of conversion lines of 8 to 1600 kev energy were obtained. Very light isotopes of Lu and Tm, each eight mass units from the mass stability line, were produced. The following activities were studied: Tm^{161} (~30 min), Ho^{161m} (E3, 211 kev), Tm^{163} (2 hr), and Lu^{167} (54 min), all previously unreported, as well as Tb^{161}, Ho^{161}, $Tm^{165,167}$, Yb^{167}, $Lu^{169,171,173}$, Hf^{173}, and possibly Yb^{169m}. Genetic relationships and partial level schemes for decay chains of masses 151 to 173 are shown. Where comparison is possible, excellent agreement with the predictions of Mottelson and Nilsson is obtained, particularly for the case of the various isotopes of Tb (Z = 65), Ho (Z = 67), and Tm (Z = 69), where striking similarities in the level structure are observed. (auth)

18540

LONGITUDINAL POLARIZATION OF POSITRONS FROM THE DECAY OF O^{14}. J. B. Gerhart, F. H. Schmidt, H. Bichsel, and J. C. Hopkins (Univ. of Washington, Seattle). Phys. Rev. 114, 1095-1100(1959) May 15.

The longitudinal polarization of 1.2-Mev positrons from the well-known 0+ → 0+ transition of 72-second O^{14} has been measured. Positrons, selected by a magnetic spectrometer, were allowed to annihilate in a plastic scintillator. Annihilation-in-flight photons were analyzed for circular polarization by Compton scattering from magnetized iron. The positrons were found to have right-handed longitudinal polarization $(+0.73 \pm 0.17)v/c$. (auth)

18541

PHOTOPROTON CROSS SECTIONS OF CARBON. S. Penner and J. E. Leiss (National Bureau of Standards, Washington, D. C.). Phys. Rev. 114, 1101-9(1959) May 15.

The partial (γ,p) cross section of carbon in which the residual boron nucleus is left in the ground state has been measured with a thin-crystal proton spectrometer. This cross section is shown to decrease from about 10 mb at the giant resonance peak (22 Mev) to about 0.1 mb near 60-Mev photon energy. Angular distributions measured at five energies exhibit an asymmetry around 90° which increases rapidly with increasing energy. The partial cross section to the first excited state of boron is (7 ± 16)% of the ground-state cross section. The partial cross section to one or more excited states of boron about 5 Mev above the ground state is comparable with the ground-state cross section above 30-Mev photon energy. In addition to the cross-section data, the measurements provide a sensitive means of calibrating the energy scales of electron accelerators at energies in the 25- to 50-Mev region. (auth)

18542

PROTON ELASTIC SCATTERING CROSS SECTIONS OF Si, Cl, K, Sc, Ti, and Mn. Sylvan Rubin, L. Evan Bailey, and Thomas O. Passell (Stanford Research Inst., Menlo Park, Calif.). Phys. Rev. 114, 1110-14 (1959) May 15.

The proton elastic scattering yields of silicon, chlorine, potassium, scandium, titanium, and manganese have been determined with respect to that from copper in the energy range 1.0-2.0 Mev at 150° laboratory angle. Two large resonances were found in silicon and two smaller ones in chlorine. The smooth regions of the curves do not vary significantly from the Rutherford values. (auth)

18543

ENERGY LEVELS OF B^9 AND O^{15}. B. Povh (California Inst. of Tech., Pasadena). Phys. Rev. 114, 1114-16 (1959) May 15.

Energy levels of B^9 have been investigated by the $B^{10}(He^3,\alpha)B^9$ reaction. Alpha-particle groups leading to the ground, 2.37-Mev and 2.83-Mev states of B^9 have been found. There is no evidence for any well-defined state between the ground state and 2.37-Mev state of B^9. The $O^{16}(He^3,\alpha)O^{15}$ reaction has been studied in the neighborhood of 5-Mev excitation in O^{15} and excited states have been found at 5.247- and 5.195-Mev energy in O^{15}. (auth)

18544

COLLECTIVE AND INTERPARTICLE INTERACTIONS IN EVEN-EVEN NUCLEI. B. James Raz (Argonne National Lab., Lemont, Ill.). Phys. Rev. 114, 1116-23 (1959) May 15.

The calculation using two equivalent $f_{7/2}$ particles and adding surface effects to the two-body interaction is reported. The effects of increasing the strength of the surface interaction and the two-particle interaction are computed. The qualitative regularities observed in even-even nuclei in the so-called vibrational region are obtained and the agreement is somewhat better than

that with the pure vibrational model. In contrast to earlier calculations, these results can give a spin of 2^+ for the second excited state, as often observed. The calculated ratio of B(E2; $2' \rightarrow 2$) to B(E2; $2 \rightarrow 0$) is less than 1.0. The appropriate values of the deformation parameters x are less than 1.0. (auth)

18545

SELF-INDICATION RESONANCE NEUTRON EXPERIMENTS WITH SILVER (2—200 ev). James E. Draper (Brookhaven National Lab., Upton, N. Y. and Yale Univ., New Haven). Phys. Rev. 114, 1124-32(1959) May 15.

A method is given for the area analysis of resonance neutron self-indication experiments including consideration of the effects of energy resolution, wing area, energy dependence of neutron flux, v^{-1} term in the capture cross section, potential scattering, detailed treatment of Doppler broadening, and scattering events preceding capture in the detector sample. The essential result of this measurement alone is nearly the peak total cross section of the Doppler broadened resonance (viz., $\sigma_{t0}\Psi_0/\Psi_0^{1/2}$) which with approximate knowledge of Γ gives σ_{t0}. Experimental results are given for eleven resonances below 200 ev in silver, and they are compared with results obtained by other methods. (auth)

18546

STUDY OF THE K CAPTURE—POSITRON RATIO OF THE TRANSITION I^{126} (2–) → Te^{126} (2+). D. S. Harmer and M. L. Perlman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 1133-8(1959) May 15.

The relative probabilities of K-electron capture and of positron emission have been measured for the transition of I^{126}(2–) to the first excited state of Te^{126}(2+). Direct measurement by a triple-coincidence method of the K/β^+ ratio gave the value 145 ± 4. The energy of the positron transition to the ground state (2– → 0+) was found to be 1.129 ± 0.005 Mev. The energy of the inner positron transition was determined to be 0.459 ± 0.007 Mev by subtraction of the measured energy of the first-excited state of Te^{126}, 0.670 ± 0.005 Mev, from the ground-state-transition energy. The K/β^+ ratio of the 2– → 2+ transition and the ratios for analogous transitions occurring in As^{74} and Rb^{84} are compared with ratios computed from a model based on shell considerations. Measurements were made also of the two higher energy positron spectra of I^{124}; the end-point energies were found to be 2.136 ± 0.010 Mev and 1.53 ± 0.02 Mev. (auth)

18547

PHOTONUCLEAR CROSS SECTIONS FOR A^{40}. A. S. Penfold and E. L. Garwin (Univ. of Chicago). Phys. Rev. 114, 1139-42(1959) May 15.

The (γ,p), (γ,np), (γ,n), and $(\gamma,2n)$ cross sections for Ar^{40} are presented. The (γ,p) cross section has a peak at 23.5 Mev while the (γ,n) cross section peaks at 16.5 Mev and the $(\gamma,2n)$ peaks at 20 Mev. The (γ,np) cross section peaks at 27.5 Mev. The total absorption cross section for Ar^{40} has a peak height of 86 mb at 23.5 Mev and a full width at half maximum of 10.3 Mev. The integrated total cross section is 470 ± 70 mb-Mev to 23 Mev and 900 ± 180 mb-Mev to 40 Mev. The shapes of these cross sections are discussed and a need for further investigation of energy and angular distributions of photoprotons from argon is indicated. (auth)

18548

DETERMINATION OF NUCLEAR REACTION MECHANISMS FROM ENERGY SPECTRA OF EMITTED PARTICLES. Bernard L. Cohen and Allen G. Rubin (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 1143-5(1959) May 15.

Energy spectra of deuterons and tritons from (p,d) and (p,t) reactions are found to be peaked near their maximum energy, in contrast to the spectra of protons from (d,p) and (t,p) reactions which are peaked at low energy. It is shown that this characteristic of inverse reactions is to be expected from "stripping" and "pickup" reactions as a consequence of the fact that the former excite "particle" states while the latter excite "hole" states, but that is not expected from collision type reaction mechanisms (e.g., "knockout"). It is thus concluded that (t,p) and (p,t) reactions as well as (d,p) and (p,d) reactions proceed by "stripping" and "pickup." The shape of energy spectra from (p,α) and (α,p) reactions indicates that the non-compound-nucleus portion of these also goes by "pickup" and "stripping;" there is corroboratory evidence for this from absolute cross sections. (auth)

18549

LOWER EXCITED STATES OF Ca^{42}. H. Morinaga, N. Mutsuro, and Masumi Sugawara (Tohoku Univ., Sendai). Phys. Rev. 114, 1146-7(1959) May 15.

Weak gamma rays in the decay of K^{42} were investigated in order to give spin-party assignments for low-lying excited states of Ca^{42}. The second excited state was found to be a 0^+ state from directional correlation measurements and the third excited state has low spin value, probably 2^+. Except for these two states the level sequence seems to be very much like that of Ti^{50} which has a similar configuration of two $f_{7/2}$ nucleons outside of a doubly magic core. (auth)

18550

POLARIZATION OF THE Al^{27} NUCLEI IN RUBY. J. A. Cowen, W. R. Schafer, and R. D. Spence (Michigan State Univ., East Lansing). Phys. Rev. Letters 3, 13-14(1959) July 1.

In the course of a series of studies of the relaxation process of the aluminum nucleus in ruby it was found possible to observe either enhanced nuclear absorption or emission signals by driving a microwave transition of the chromium impurity. The crystal, containing 0.1% chromium, was cooled to 4.2°K and was irradiated with microwave power at 9300 Mc/sec. (W.D.M.)

18551

EVIDENCE FOR SHELL-MODEL STATES IN Sc^{41}. C. M. Class, R. H. Davis, and J. H. Johnson (Rice Inst., Houston, Tex.). Phys. Rev. Letters 3, 41-3 (1959) July 1.

Additions to the body of information available on Sc^{41} were made by studying the elastic scattering of protons from Ca^{40}. The measurements were carried out at energies of 1.2 to 5.5 Mev, corresponding to excitation energies in Sc^{41} between 2.8 and 7 Mev. The protons were detected at 90, 125, and 150° with respect to the beam direction by a CsI crystal spectrometer which satisfactorily resolved the elastic groups from Ca and C. The shapes of the resonances were analyzed by application of dispersion theory. (W.D.M.)

18552

ENERGY SPECTRUM OF PHOTONEUTRONS FROM OXYGEN. Carmelo Milone (Centro Siciliano di Fisica Nucleare, Catania, Italy). Phys. Rev. Letters 3, 43-4 (1959) July 1.

The energy spectrum of the photoneutrons from oxygen was studied by irradiation of a water target with a 31-Mev collimated bremsstrahlung beam. Photoneu-

trons emitted at about 90° were recorded by means of the proton recoil tracks in Ilford plates 400 μ thick. The neutron spectrum is deduced from the proton recoil spectrum taking into account the (n,p) collisions in hydrogen of the emulsion. (W.D.M.)

18553

TRIPLE ISOMERISM IN Ir^{192}. Gertrude Scharff-Goldhaber and Michael McKeown (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters 3, 47-50(1959) July 1.

In studying an iridium specimen irradiated for one month in the BNL Reactor and then allowed to cool, a gamma spectrum identical with $Ir^{192}g$ was obtained, but corresponding to a source strength of 2820 ± 140 disintegrations per sec. As $Ir^{192}g$ is known to have a 1.45-minute isomer, decaying mainly by a 58-kev isomeric (E3) transition to the 74-day ground state, it was concluded that the observed activity stems from a third, longer lived isomer of Ir^{192}. After various studies on the isomer a lower limit of $T_{½} > 5$ yr was set. (W.D.M.)

18554

OXYGEN-20. Nelson Jarmie and Myron G. Silbert (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 3, 50(1959) July 1.

An experiment is described in which the reaction $O^{18}(t,p)O^{20}$ was definitely established as occurring. Two proton groups associated with O^{20} were observed. The Q for the reaction was found to be 3.12 ± 0.04 Mev which gave a preliminary value for the mass of O^{20} of 20.01036 ± 0.00004 amu. The beta disintegration energy for the $O^{20} \rightarrow F^{20}$ decay was calculated to be 3.75 Mev. The first excited state of O^{20} was found to be at an energy of 1.70 ± 0.05 Mev above the ground state. (W.D.M.)

18555

NUCLEAR POLARIZATION VIA "HOT" CONDUCTION ELECTRONS. G. Feher (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 3, 135-7(1959) Aug. 1.

A polarization scheme similar in principle to the Overhauser effect is proposed which does not require an external radio-frequency field in order to saturate the electron spin. It is based on the difference between the electron spin temperature and the temperature corresponding to the mean kinetic energy of the electrons accelerated in a d-c electric field. A preliminary experiment on electrons in silicon demonstrates the existence of a large temperature difference. (W.D.M.)

18556

POLARIZATION MEASUREMENTS ON NUCLEAR GAMMA RAYS. Lawrence W. Fagg (Naval Research Lab., Washington, D. C.) and Stanley S. Hanna (Argonne National Lab., Lemont, Ill.). Revs. Modern Phys. 31, 711-58(1959) July.

A review of polarization-sensitive processes and different methods for measurements of polarization of nuclear gamma rays is given. Experimental results are presented in tabular form, the various processes being classified according to the type of orientation which is produced, either alignment or polarization. The possible polarization correlation for each case is listed. (C.J.G.)

18557

DETERMINATION OF THE BETA-DECAY INTERACTION FROM ELECTRON-NEUTRINO ANGULAR CORRELATION EXPERIMENTS. James S. Allen (Univ. of Illinois, Urbana). Revs. Modern Phys. 31, 791-6(1959) July.

The methods used to obtain a series of measurements of the angular correlations in the allowed beta decay of He^6, Ne^{19}, Ne^{23}, and Ar^{35} are described. Schematic diagrams of the apparatus used in various experiments are given. The results prove that the dominant interactions are vector for the Fermi type of decay and axial-vector for the Gamow-Teller decays with the dominant interaction form being VA. The present experiments do not exclude a possible tensor admixture of 10% or less. A scalar mixture of the same magnitude may also be present. (C.J.G.)

18558

ENERGY LEVELS OF Zn^{65}. A. K. Walt'er, I. I. Zalyubovskii, O. P. Klyucharev, and V. P. Lutsik (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R. and Kharkov State Univ.) Ukrain. Fiz. Zhur. 4, 46-51(1959) Jan.-Feb. (In Ukrainian)

Gamma transitions in Zn^{65} were studied by investigating the $Cu^{65}(p,n\gamma)Zn^{65}$ and $Zn^{64}(p,\gamma)Ga^{65}$ reactions which result in the residual Zn^{65} nucleus after decay of Ga^{65}. The energy level scheme of Ga^{65} was established in accordance with both reactions. The half life of Ga^{65} was measured, and the decay scheme of this nucleus determined. (auth)

18559

MEASUREMENT OF THE EFFECTIVE CROSS SECTION OF THE $C^{12}(p,\gamma)$ REACTION. O. S. Deineko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 52-6(1959) Jan.-Feb. (In Ukrainian)

The effective cross section of the $C^{12}(p,\gamma)$ reaction was measured in the energy range from 200 to 400 kev. The method of quantitative determination of the β-active product of the reaction was used. The target consisted of a pure carbon of natural isotopic composition. The positron activity was measured by an end-face counter with a mica window 15 μ thick. The counting efficiency of the counter was determined by a comparison of the relative yield curve which was obtained with the aid of the counter and a valve-electrometer. The results were compared with those of other authors. The comparison shows a satisfactory agreement of the given cross sections. A satisfactory agreement was also obtained on comparing the theoretical calculations by the Breit-Wigner formula with the assumption of constant resonance at 456 kev. (auth)

18560

ENERGY OF NEUTRONS FROM CAPTURE OF NEGATIVE μ-MESONS IN LEAD NUCLEI. W. Ball and K. H. Lauterjung (Max-Planck-Institut fur Kernphysik, Heidelberg, Ger.). Z. Naturforsch. 14a, 581-2(1959) May-June. (In German)

Experiments are described in which neutrons produced by μ^- capture in Pb were detected by paraffin recoil protons causing fluorescence in ZnS(Ag). The experimental set-up is described. The data show that most of the neutrons have energies below 3 Mev. Since the neutrons, according to their point of origin, have traveled great distances in the μ-meson absorber and have been left as lower-energy neutrons on the basis of their energy loss through inelastic scattering in the Pb, the total intensity of recoil protons is very small, though 25 captures/minute were recorded. An even larger recoil-proton count rate would be expected if neutrons with energies greater than 25 Mev were selected. (T.R.H.)

18561

INTERACTION BETWEEN 660 Mev PROTONS AND ATOMIC NUCLEI AND THE NUCLEAR INTERNAL MOMENTUM DISTRIBUTION OF NUCLEONS. L. S. Azhgirei, I. K. Vzorov, V. P. Zrelov, M. G. Meshcheryzkov, B. S. Neganov, R. M. Ryndin and A. F. Shabudin (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1631-49(1959) June. (In Russian)

An investigation by magnetic analysis is carried out on the angular distributions and on the energy spectra of secondary particles (mainly protons with energies of $\gtrsim 60$ Mev) emitted at angles of 7, 12.2, 18, 24, and 30° in reactions between 660-Mev protons and the nuclei of Be, C, Cu, and U. The cross sections for the emission of such secondary charged particles increase with decrease of the angle. In the order of decreasing energy the various spectral regions of all investigated elements correspond respectively to diffractional scattering of protons on nuclei (in the small angle region), single quasi-elastic proton-nucleon collisions, π-meson production on bound nucleons, and intranuclear cascade. The experimental energy spectra for single quasi-elastic proton-nucleon scattering are compared with the spectra computed in the impulse approximation under various assumptions regarding the momentum distributions of the nucleons in the nuclei. The Be and C data are consistent with a Gaussian nucleon momentum distribution with a 1/e value at an energy of approximately 20 Mev. (auth)

18562

NUCLEON-NUCLEON SCATTERING IN HIGH ANGULAR MOMENTUM STATES. A. F. Grashin (Moscow Engineering and Physics Inst.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1717-24(1959) June. (In Russian)

The properties of the one-pion exchange approximation of nucleon-nucleon elastic scattering are considered in detail. The scattering phase shifts are computed. A new procedure for phase shift analysis is suggested which should lead to a reduction of the multiplicity of the solution and permit one to obtain more accurately the experimental phase shifts. (auth)

18563

RESONANCE EFFECTS IN THE SCATTERING OF PARTICLES NEAR THE REACTION THRESHOLD. A. I. Baz. Zhur. Eksptl'. i Teoret. Fiz. 36, 1762-70 (1959) June. (In Russian)

The energy dependence of the scattering cross section X(a,a)X near the threshold of the reaction X(a,b)Y (X, a, b, and Y are arbitrary particles) is studied under the assumption that long-range attractive forces act between b and Y. It is shown that if these forces are capable of producing a bound state of particles b + Y, then resonances should be observed in the scattering cross sections. These resonances are located below the threshold of the reaction X(a,b)Y. A detailed study is made of the case when attractive coulomb forces act between b and Y. The number of resonances in this case is found to be infinite and their density tends to infinity when the threshold is approached from below. (auth)

18564

TRANSITION PROBABILITIES BETWEEN THE LEVELS OF THE ROTATIONAL BAND OF NONAXIAL NUCLEI. A. S. Davydov and V. S. Rostovskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1788-96(1959) June. (In Russian)

The energies and wave functions of the rotational states ($J \geq 4$) of nonaxial nuclei are calculated. The reduced probabilities for E2 transitions are derived. Conditions under which the rotational states can be characterized by quantum numbers K are ascertained. It is shown that when the shape of the nucleus deviates from axial symmetry the interval rule 1:3, 3:7:12 observed in the rotational band of axial nuclei is violated. The theory is compared with experimental results. (auth)

18565

INVESTIGATION OF THE SUPERFLUID STATE OF ATOMIC NUCLEI. V. G. Solov'ev (Joint Inst. of Nuclear Research, Dubna, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1869-74(1959) June. (In Russian)

The variational principle proposed by N. N. Bogolyubov and the physical ideas and mathematical methods developed in the theory of superconductivity are applied to a study of the properties of heavy nuclei. Residual interactions between nucleons located in the outer shell which lead to the appearance of the superfluid state of the nucleus are considered from the viewpoint of the nuclear shell model. The energy of the ground superfluid state and of a set of excited states is computed for even as well as odd number of nucleons in the shell. Some regularities in the level pattern of even-even nuclei and nuclei with odd A values are revealed. The energy changes of the ground nuclear state caused by a change of the number of nucleons in the outer shell by unity were calculated. From these calculations it can be concluded that even-even nuclei are stable with respect to β decay as compared to odd-odd nuclei, and the results quantitatively agree with the semi-empirical Weizsacker formula. The results depend slightly on the nuclear model chosen and are also valid for strongly deformed nuclei. (auth)

18566

EXCITATION OF COLLECTIVE STATES IN NUCLEI BY SCATTERING OF CHARGED PARTICLES. S. I. Drozdov. Zhur. Eksptl'. i Teoret. Fiz. 36, 1875-81 (1959) June. (In Russian)

Elastic and inelastic scattering of fast charged particles on black nonspherical nuclei is investigated in the diffractional approximation. The radius of the nucleus and its nonsphericity parameter can be determined by comparing the calculations with the experimental data. (auth)

18567

EFFECTS OF NUCLEAR SHELL ON THE DISTRIBUTION OF KINETIC ENERGY FRAGMENTS IN FAST NEUTRON FISSION. A. N. Protopopov and I. A. Baranov, Yu. A. Selitskii, and V. P. Eismont. Zhur. Eksptl'. i Teoret. Fiz. 36, 1932-3(1959) June. (In Russian)

A double ionization chamber was used in finding the complete kinetic energy distribution of U^{238} fragments produced by 14.9-Mev neutron fission. The obtained data were plotted and compared to the data on the kinetic energy distribution of fragments from the U^{235} fission by 14.1-Mev neutrons and to the calculated dispersion. It was found that E and ΔE have the highest magnitudes with the fragment mass ratio 1.25 to 1.3. A diagram is also included of changes in the kinetic energy distribution in the U^{235} fission by thermal neutrons and in the spontaneous fission of Cf^{252} measured by the time-of-flight method. It was observed that in all events the kinetic energy values are highest when the heavy fragment has a mass number near 132. This probably

represents a filled shell nucleus with 50 protons and 82 neutrons. A break in the curve was found at the fragment mass ratio corresponding to a light fragment with the mass number 82 to 84, which indicates a closed shell with 50 neutrons. A similar closed shell effect was also observed in the dispersion energy (ΔE) relation to the fragment mass ratio which was determined for U^{233} and U^{235} by D. C. Brunton et al. (Phys. Rev. 75, 990, 1949). (R.V.J.)

18568

INTERACTIONS OF ACCELERATED NITROGEN AND BISMUTH NUCLEI. V. A. Karnaukhov (Inst. of Atomic Energy, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1933-5(1959) June. (In Russian)

Reactions of N^{14} and bismuth involving the production of α-active isotopes were studied at ~ 102 Mev. A luminescence α counter, insensitive to β and γ background, was used for investigating the bismuth decay activity. The α energy was measured with an ionization chamber, and the characteristics of the α radiation formed are tabulated. Alpha activities were attributed to Rn^{212} ($T_{1/2}$ = 16 hours, E_α = 5.82 Mev), in equilibrium with At^{211} ($T_{1/2}$ = 7.5 hours, E_α = 5.89 Mev) and Po^{211} ($T_{1/2}$ = 0.5 sec, E_α = 7.43 Mev), and Ra^{212} ($T_{1/2}$ = 23 min, E_α = 6.23 Mev). The relation of Rn^{212} and Rn^{211} production cross sections to the nitrogen ion energy is presented graphically, as well as the fission cross section σ_f of the constituent nucleus Th^{223} which practically coincides with the cross section of its formation. Isotopes Rn^{212} and Rn^{211} can appear as the result of (N, 3n) and (N, 4n) reactions as well as in α emission reactions (N, xα3n) and (N, xα4n), x = 1,2. The more probable reaction may be determined from the dependence of Rn^{212} and Rn^{211} production cross sections on the energy of the nitrogen nuclei. The cross sections for the reactions (N, 3n) and (N, 4n) are presented. A comparison of experimental and theoretical curves leads to the conclusion that (N, 3n) and (N, 4n) reactions contribute (>50%) to the yield of Rn^{212} and Rn^{211} only with a nitrogen ion energy below 78 and 86 Mev, respectively. At higher energies the yield of these isotopes is determined by (N, xα3n) and (N, xα4n) reactions. The isotope with a half life ~150 days is Po^{210} which is produced by various reactions (N, xαn), (N, p4n), (N, N^{13}), etc. The cross section of Po^{210} production increases with energy, reaching the magnitude ~ 10^{-25} cm^2 at E = 100 Mev. (R.V.J.)

18569

PROTON SCATTERING ON TRITIUM AT LOW ENERGIES. Yu. G. Balashko, I. Ya. Barit, and Yu. A. Goncharov (Lebedev Inst. of Physics). Zhur. Eksptl'. i Teoret. Fiz. 36, 1937-9(1959) June. (In Russian)

Measurements were made of p–T scattering at energies below the T(p,n) reaction threshold in order to determine the existence of ~20 Mev He^4 levels. A target chamber filled with hydrogen and deuterium was used for estimating the α particle yield from the reaction T(d,n)α. The triton elastic scattering cross sections in hydrogen were measured at triton bombarding energies below 530 kev for three angles. The results are plotted for the energies up to 200 Mev. (R.V.J.)

18570

LIFE-TIMES OF Rb^{85} AND Pr^{141} EXCITED STATES. N. A. Burgov, A. V. Davydov, and G. R. Kartashov (Inst. of Teoretical and Experimental Physics, Academy of Sciences, U.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1946-7(1959) June. (In Russian)

The method of retarded β–γ coincidences was used for measuring the lifetime of Rb^{85} at the 150-kev level and Pr^{141} at the 142-kev level. The data processed by the method of smallest quadratics showed $\tau_\gamma(Rb^{85}) = 1.14 \pm 0.12 \times 10^{-9}$ sec, $\tau_\gamma(Pr^{141}) = 2.32 \pm 0.17 \times 10^{-9}$ sec, in good agreement with previous works. The ratio of the experimentally determined lifetimes for single-particle transitions was 210 and 230 for Rb^{85} and Pr^{141}, respectively. (R.V.J.)

Theory

18571 KAPL-M-ELW-9

Knolls Atomic Power Lab., Schenectady, N. Y.

A GENERALIZATION OF THE THEORY OF FLUX SYNTHESIS. E. L. Wachspress. May 15, 1959. 15p. Contract W-31-109-Eng-52. $3.30(ph), $2.40 (mf) OTS.

Three-dimensional diffusion calculations are time consuming and expensive. Fine detail is sometimes included for the sole purpose of determining reasonably accurate region averaged fluxes. A flux synthesis technique developed at WAPD has met with moderate success in eliminating the need for three-dimensional calculations. A scheme for extending the applicability of flux synthesis techniques is described. (W.D.M.)

18572 NDA-84-24(Vol.I)

Nuclear Development Corp. of America, White Plains, N. Y.

THEORETICAL METHODS FOR THE CALCULATION OF D_2O LATTICES. W. L. Brooks and N. Tralli. July 17, 1959. 65p. Project II. Contract AT(30-1)-2303. $10.80(ph), $3.90(mf) OTS.

Results of a program are given which seeks to find a method of calculating the reactivity of heterogeneous lattice-type reactors. The method sought would differ from methods currently in use in that it would need only microscopic data as imput and would rely on experiments for the establishment of parameter values. The results for a large number of single rod lattices are summarized. Earlier work in this program is reported in NDA-84-17. (W.D.M.)

18573 NIRNS-LN-1

Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England.

LECTURE NOTES—WINTER SCHOOL ON DISPERSION RELATIONS OXFORD, JANUARY 1959. 119p.

Nine lectures by J. Hamilton on dispersion relations are presented starting with the original applications to optics and working up to the present. Also included are notes from three seminars by P. T. Matthews on K-meson dispersion relations, J. G. Taylor on the determination of strange particle parities and coupling constants, and J. C. Polkinghorne on dispersion relations for inelastic processes. (W.D.M.)

18574 NP-7724

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics.

ON WAVE EQUATIONS FOR ZERO AND NONZERO REST MASS. V. G. Ogievetskii (Ogievetsky) and I. V. Polubarinov. 1959. 13p.

It is proved that nonzero rest mass wave equations are invariant under the 15-parameter group of transformations. This group is a representation of the conformal group. (auth)

18575 NP-7727

Komenského Universita V Bratislava, Czechoslovakia.
TENSOR ASPECTS OF QUANTUM FIELD THEORY. Milan Petraš. May 1959. 34p.

A metric space of certain complex-valued functions of a point in space-time is introduced with symmetrical, nondegenerate, indefinite metrics determined by the Klein-Gordon operator. The equations of the quantum theory of a scalar field with self interaction are then formulated as tensor equations in the space. A new equation which allows one to consider the problem of computing the Green functions as an "initial value problem" is derived and solved formally by the method of repeated integration. (auth)

18576 NP-7790

Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy.
REMARKS ON THE OPTICAL MODEL OF A NUCLEUS. V. G. Grishin and M. I. Podgoretskii (Podgoretsky). 1959. 11p.

18577 NP-7814

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
RELATIVISTIC COULOMB WAVE FUNCTION WITH DEFINITE ASYMPTOTIC MOMENTUM AND POLARIZATION. Report No. 83/VII. A. Deloff. May 1959. 7p.

Recently the author attempted to find a relativistic wave function $\Psi(\vec{r}, \vec{p}, \sigma)$ with definite asymptotic momentum $\vec{p}$ and polarization σ which could be applied to β decay theory. However, the wave function found was not exact since it contained some multipole expansions in which only terms necessary for allowed and first forbidden transitions were kept. A Coulomb wave function in an exact and much simpler form is given. (W.D.M.)

18578

A CORRELATION BETWEEN EQUATIONS OF MOTION AND FIELD EQUATIONS. Czesław Jankiewicz (Universität, Wrocław, Poland). Acta Phys. Polon. 18, 21-35(1959). (In German)

By using Lieschen differentials, it is shown that in any classical field theory formulated on the basis of the general relativity principle, the equations of motion of the continuously dispersing field source result from the field equations, and that the equations of motion are identical with the conservation principles. Gravitation theory and electrodynamics serve as examples. (auth)

18579

QUANTUM EFFECTS NEAR A BARRIER MAXIMUM. Kenneth W. Ford and David L. Hill (Los Alamos Scientific Lab., N. Mex.) and Masami Wakano and John A. Wheeler (Princeton Univ., N. J.). Ann. Phys. (N. Y.) 7, 239-58(1959) July.

A potential barrier is considered which is parabolic over an appreciable region near its maximum. When the motion is unbounded to both left and right, the barrier penetrability is the quantity of interest. It does not follow the Gamow value near the summit, but instead shows a transition behavior previously derived and here related to other phenomena. When the motion is symmetrically bounded on both left and right, energy levels below the barrier maximum are known to be associated in pairs of even and odd states, and are generally tacitly assumed to be unpaired above the barrier. The present analysis leads to a transition formula which shows that the pairing effect never vanishes but falls off smoothly with increase of the energy across the barrier maximum. When the motion is bounded to the left of the barrier and unbounded on the right, the quantity of interest is the phase shift. A "mixing formula" is derived which combines the semiclassical JWKB phase integrals to the left and right of the barrier to give a phase shift that varies smoothly through the barrier. In the analysis appears the function $\Gamma(\frac{1}{2} + i\epsilon)$, for which a simple optional approximation formula is presented. Typical curves are presented for the phase shift as a function of energy in the transition region. The analysis is used in an accompanying paper as the basis of a discussion of the special case of scattering which is known as orbiting, where classically a particle spirals near a potential maximum. (auth)

18580

SEMICLASSICAL DESCRIPTION OF SCATTERING. Kenneth W. Ford (Indiana Univ., Bloomington, Ind. and Los Alamos Scientific Lab., N. Mex.) and John A. Wheeler (Princeton Univ., N. J.). Ann. Phys. (N. Y.) 7, 259-86(1959) July.

The quantum-mechanical scattering amplitude can be simply related to the classical deflection function when the conditions for a semiclassical analysis of the quantum-mechanical scattering are met. Various interesting characteristic features of the scattering are related to special features of the classical deflection function. The characteristic types of scattering discussed are: interference, when the deflection function possesses more than one branch at a given angle; rainbow scattering, when the deflection function has a relative maximum or minimum; glory scattering, when the deflection function passes smoothly through 0° or through an integral multiple of $\pm\pi$; and orbiting, when the deflection function possesses a singularity. The consideration of the characteristic features of semiclassical scattering makes possible the analysis of an observed differential cross section to yield the classical deflection function, which in turn may be used to construct the potential. (auth)

18581

APPLICATION OF SEMICLASSICAL SCATTERING ANALYSIS. Kenneth W. Ford (Indiana Univ., Bloomington and Los Alamos Scientific Lab., N. Mex.) and John A. Wheeler (Princeton Univ., N. J.). Ann. Phys. (N. Y.) 7, 287-322(1959) July.

Several different examples of scattering processes are analyzed, and for each, semiclassical approximations are discussed. The scattering of magnetic monopoles by charged particles is an illustrative example demonstrating rainbow and glory effects. In this example, exact classical and quantum results are also obtained and comparison made with semiclassical results. For the scattering of alpha particles by nuclei, the influence of absorption and of the phenomenon of orbiting on the cross section are studied semiclassically, and comparison with experiment is made. For the scattering of atoms by atoms, rainbow, glory, and orbiting effects may all exist, and one example is worked out semiclassically in detail. The scattering of electrons or muons by nuclei is discussed briefly and the semiclassical analysis shown not to be valid at any energy. (auth)

18582

SOME PROSPECTS FOR THE PRODUCTION AND OBSERVATION OF NEW PARTICLES. Bernard T.

Feld (Massachusetts Inst. of Tech., Cambridge). Ann. Phys. (N. Y.) 7, 323-48(1959) July.

In order to predict the possible existence of new particles, the properties of the known particles, their production and decay characteristics, and some useful schemes for their classification are reviewed. New possibilities are considered through the extrapolation of such schemes, mainly that of Gell-Mann and Nishijima, subject to the conditions that no elementary particle be multiply charged. For each prospect, the decay and production mechanism are considered, and the predictions, following from its possible existence, are subjected to the available observational information. One is left with two prospects: a strangeness ±2, singlet, charged boson and a strangeness −3, negative, singlet hyperon. Some possible experiments for their production and observation are discussed. (auth)

18583

TRANSITION MATRIX ELEMENTS BETWEEN STATES IN A COULOMB FIELD. II. O. M. Olsson (Univ. of Stockholm). Arkiv Fysik 15, 289-301(1959).

General matrix elements expressed in terms of the Lauricella function expanded in series are presented. It is shown that this series is generally convergent and the terms are connected by a recurrence relation. The wave function is introduced in terms of one of the confluent Appell functions. (C.J.G.)

18584

A THEORETICAL STUDY OF THE INTERNAL CONVERSION WITH SPECIAL APPLICATION TO MAGNETIC DIPOLE TRANSITIONS. O. M. Olsson and Sölve Hultberg (Univ. of Stockholm and Nobel Inst. of Physics, Stockholm). Arkiv Fysik 15, 361-86(1959).

The internal conversion process has been analyzed by taking advantage of the simplifications in the mathematical formalism which are possible near the conversion threshold. The results are applied to M1 conversion in the K shell. Corrections for various nuclear charge distributions can be easily made and a general insight into the nature of the problem can be obtained, allowing such predictions as the maximum deviation possible from the so-called normal values for the internal conversion coefficients that were first computed by Sliv and Band. Magnetic dipole conversion coefficients with finite nuclear size corrections are given. (auth)

18585

CALCULATION OF THE BOUND EFFECTS OF THE ADDITIONAL TERM OF FEYNMAN AND GELL-MANN IN β DECAY. Michel Lacombe. Compt. rend. 249, 74-6 (1959) July 6. (In French)

A study was made to determine if it is possible to verify the Feynman and Gell-Mann theory on the nature of the vectorial β interaction by β-α angular correlation experiments in the case of forbidden β transitions $\Delta J = 1$, and by spectral measurements in the case of transitions where $\Delta J = 2$ (yes). (tr-auth)

18586

SOME SPECIAL PROPERTIES OF THE BOLTZMANN ELASTIC COLLISION OPERATOR. M. J.-L. Delcroix (École Normale Supérieure, Paris) and M. J. Salmon (Commissariat à l'Énergie Atomique, Paris). J. phys. radium 20, 594-6(1959) June. (In French)

Some properties (an important one is a variational property) of the Boltzmann elastic collision operator, valid in a more general framework than that of the Lorentz gas, are pointed out. (auth)

18587

TRANSFORMATION GROUPS AND DIRAC EQUATION SOLUTIONS. K. H. Tzou (Institut Henri-Poincaré, Paris). J. phys. radium 20, 597-605(1959) June. (In French)

By considering the transformation groups as simple substitutions of variables e, r, t, it is shown that, from a given solution of Dirac's equations, the symmetry group G (composed of P, T, C, and combinations) and the proper or continuous Lorentz group L can generate all solutions of these equations satisfying the same physical conditions as does the original solution, if G and L are entirely applicable. Identification of the solutions produced proceeds according to certain rules depending upon the constants of motion of the problem considered. Two examples are studied for illustration, the monochromatic plane wave and the central field problem. The identification is further stated precisely concerning the two spin values. All states of an electron are thus connected one to another by the groups G and L. The behavior of the solutions under space reflection is studied. Finally, a general solution is constructed, which is invariant against the operations of the groups G and L, and one can express in this way the usual procedure of Fourier expansion according to the group concept. Some remarks have been made on possible solutions invariant against C, CP, and CPT. (auth)

18588

CAUSALITY IN QUANTUM FIELD THEORY. S. T. Ma (Univ. of Sydney). Nuclear Phys. 11, 696-9(1959) June (2).

A recent work dealing with the relation between the causal function and the causality condition was confined to the virtual bosons taking part in the scattering of fermions. It is here extended to cover all the virtual particles of any scattering process. (auth)

18589

CONNECTION BETWEEN MASSES AND ISOBARIC SPIN. Ettore Minardi (Società Nazionale Cogne, Aosta, Italy and Istituto Nazionale di Fisica Nucleare, Turin). Nuclear Phys. 12, 35-57(1959) June (3).

A fundamental theory of the elementary particles is presented assuming a dependence of the function describing a particle on two space-time variables and symmetry of the fundamental equations between them. All masses, with the exception of charged pions and muons, but including the electron mass of purely electro-magnetic origin, are predicted with a remarkable accuracy introducing a universal length as the only adjustable parameter. The strangeness and the Gell-Mann-Nishijima scheme find a simple interpretation; the isobaric spins of the different masses arise as an automatic consequence of the formalism. It is shown that the theory implies an indefinite metric. The existence of a pion with zero isobaric spin is predicted by the theory. In the appendix an attempt is presented to explain the existence of the pions with isobaric spin T = 1 and of the muons. (auth)

18590

ON THE EXISTENCE OF SOLUTIONS OF THE BRUECKNER EQUATIONS FOR A MANY-FERMION SYSTEM. V. J. Emery (Cavendish Lab., Cambridge). Nuclear Phys. 12, 69-83(1959) June (3).

The Brueckner reaction matrix for a many-fermion system is frequently introduced as the formal "sum" of an infinite series which is a part of the complete many-body perturbation series. It is shown that, when the

system is infinite, for any "well-behaved" potential, there are always some unperturbed states for which the reaction matrix series diverges. Conditions for the existence of solutions of the integral equations for the reaction matrix are discussed and it is shown that "Cooper-type" singularities arise for potentials v(r) with not too strongly bound states provided $\int_0^\infty v(r) \sin^2 k_F \, r dr$ is not positive ($\hbar k_F$ being the Fermi momentum). Explicit calculations show that there are other types of reaction matrix singularities for nuclear matter but not for liquid helium three. The results provide a potential foundation for Belyaev's calculations of nuclear spectra and suggest that there should be no energy gap in the spectrum of liquid helium three. (auth)

18591

PARTICLE-HOLE CONJUGATION IN THE SHELL MODEL. J. S. Bell (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 12, 117-24(1959) June (3).

The idea of particle-hole conjugation is expounded in the language of second quantization. Results of Racah are rederived and in particular a theorem important for the classification of states of half-filled shells. (auth)

18592

ANALYSIS OF A ROTATIONAL STATE IN TERMS OF THE SHELL MODEL STATES. A. Arima and S. Yoshida (Univ. of Tokyo). Nuclear Phys. 12, 139-58(1959) July (1).

The wave function of a rotational state is analyzed in terms of shell model wave functions. The rotational wave function is constructed in the three-dimensional model for even nuclei according to the method of the generator coordinates. For the single particle potential the deformed harmonic oscillator well is assumed, and the spin orbit coupling is neglected. The wave function of the rotational state is expressed in terms of the shell model wave functions. The distribution function of the shell model states of given excitation-energy is found to be of Poisson type. For light nuclei in lower excited states the rotational wave function is mainly composed of the degenerate lowest shell model states, Elliott's wave functions, while for heavy nuclei or light nuclei in higher excited states the main contribution comes from shell model states with excitation energy of a few $\hbar\omega_0$, where ω_0 is the angular frequency of the harmonic oscillator. The matrix element of the quadrupole transition is also calculated. Its value, taking only the Elliott states, is found to give half the correct value, while the calculation taking into account both the Elliott states and the interference terms with the states of excitation energy $2\hbar\omega$ is found to give the right answer. (auth)

18593

AN EXAMPLE OF A FIELD THEORY WITH INDEFINITE METRIC IN HILBERT SPACE II. A. A. Komar (P. N. Lebedev Inst., Moscow) and M. A. Markov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R.). Nuclear Phys. 12, 190-203(1959) July (1).

A Lagrangian formalism is set up for the field equations proposed by Markov (Nuclear Phys. 10, 140(1959)). Energy-momentum tensors and current vectors are derived for boson and fermion fields, and the corresponding conservation laws are considered. In space-time regions close to the light cone and hyperboloid the energy density of the boson field and charge density of the fermion field are not positive definite. The integrals of these quantities over the whole volume (energy and charge) are definite. The appearance of negative densities is interpreted in accord with the modification of the concept of a particle coordinate proposed in the above reference. (auth)

18594

THE DOUBLE SPHERICAL HARMONIC METHOD FOR CYLINDERS AND SPHERES. D. W. Drawbaugh and L. C. Noderer (Combustion Engineering, Inc., Windsor, Conn.). Nuclear Sci. and Eng. 6, 79-81(1959) July.

Double spherical harmonics moment equations (J. Yvon, J. Nuclear Energy 4, 305(1957)) for the cylinder and sphere are obtained by making use of a product of distributions defined by H. Koenig (Math. Nachr. Berlin 9, 129(1953)). (C.J.G.)

18595

ON THE EMISSION OF LOW ENERGY PHOTONS FROM A QUANTIZED SYSTEM. R. Ascoli (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10) 12, 191-217(1959) May 1.

The problem is solved of the emission of photons from a general quantized system when the reaction of the photons on the system is neglected. A general expression was deduced for the average number of photons which are emitted when a time-dependent perturbation produces a transition between two arbitrary states of the system. The discussion of this expression leads to the conclusion that the average number of low-energy photons emitted in any experiment which can really be done is finite. Neglecting the reaction of the photons on the charges, it is shown that the average number of emitted photons is equal to the first term of the expansion in powers of e of the emission probability of one photon. The application of this conclusion to the case of a transition between two definite momentum states shows that the Bloch-Nordsieck divergence and the infrared divergence of the perturbative calculation have their origin in the divergence of the same mathematical expression, although they have an entirely different physical meaning. It is shown that the problem studied in general has no meaning in the case of a time-independent perturbation. (auth)

18596

ON QUANTIZATION WITH AN INDEFINITE METRIC AND THE LEE MODEL. B. Ferretti (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 12, 395-430(1959) June 1.

The Lee model is discussed in the case already considered by Pauli and Källén, i.e., when the characteristic equation of the eigenvalues of the energy has only real and all different roots. It is proved that introducing a suitable redefinition of the ingoing and outgoing states it is possible to construct a unitary S-matrix having reasonable physical properties. The suggested procedure is in some way similar to a renormalization which eliminates the ghost effects. (auth)

18597

ON THE EXISTENCE AND THE UNITARY PROPERTY OF THE SCATTERING OPERATOR. S. T. Kuroda (Univ. of Tokyo). Nuovo cimento (10) 12, 431-54(1959) June 1.

The mathematical character of the scattering theory is investigated according to the time-dependent formulation with special emphasis on the wave and the scattering operators. The main contents are: (1) some general properties of these operators are summarized;

(2) the existence of the wave operator is proved under rather mild conditions on the potential; and (3) the existence and the unitary property of the scattering operator are proved under certain additional conditions. The arguments are mathematically rigorous. (auth)

18598

PRODUCTION OF THE MAGNETIC FIELD OF THE CRAB NEBULA. L. Marshall (Univ. of Chicago). Nuovo cimento (10) 12, 477-82(1959) June 1.

The magnetic field of the Crab Nebula is so large that if the original pre-super nova star had contained it, it must have been on the verge of instability. It is suggested that this magnetic field did not exist before the explosion which produced the Crab but was created from the kinetic energy of the expanding matter. To account for the observed magnetic field of $\sim 10^{-3}$ G a machinery is proposed which derives, from the existence of shock waves in the exploding shell, from the existence of charge separation in the shock fronts, and from the formation of irregularities in the surfaces where charge separations exist, at some time during their propagation from regions of very high density in the star interior out into the very low galactic density. The magnetic field of 10^{-3} G, now believed to exist in the Crab, follows from the present theory, if one assumes the experimental value of $10^3/cm^3$ for the density in the filaments. (auth)

18599

POSSIBLE TESTS OF THE VALIDITY OF ELECTRODYNAMICS AT SHORT DISTANCES. G. Andreassi, P. Budini, and I. Reina (Università, Trieste, Italy and Istituto Nazionale di Fisica Nucleare, Trieste, Italy). Nuovo cimento (10) 12, 488-9(1959) June 1.

The differential cross section in the positron-electron annihilation process is obtained in the laboratory system. Accuracy measurements are given. (C.J.G.)

18600

IONIC THEORY OF PLASMAS AND MAGNETOHYDRODYNAMICS. H. S. Green (Dublin Inst. for Advanced Studies). Phys. Fluids 2, 341-9(1959) July-Aug.

Attempts to remove certain sources of confusion in plasma theory by deriving a complete set of macroscopic equations based on the ionic theory are reported. Relativistic and quantum effects are usually neglected, and an approximation equivalent to that of the macroscopic theory of irreversible processes is adopted. But there is no other approximation, and in particular multiple interactions are fully accounted for. The theory of the dielectric constant and permeability of plasmas is sketched, and there follows an ionic derivation of the equations of continuity, and of energy and momentum transport, based on an exact separation of the long-range and short-range forces. It is shown how the short-range forces contribute to the pressure, the energy flux, and the flux of entropy. The ionic basis of the theory of irreversible processes is discussed, and its relevance to the generalization of Ohm's law. In an appendix, the formal statistical thermodynamics of plasmas is developed in a way which avoids certain difficulties associated with the long-range interactions. (auth)

18601

SPACE-TIME PROPERTIES AND INTERNAL SYMMETRIES OF STRONG INTERACTIONS. Gerald Feinberg (Brookhaven National Lab., Upton, N. Y.) and Feza Gürsey (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 114, 1153-70(1959) May 15.

Theorems relating the separate conservation of C and P in pion-nucleon interactions to CP invariance, the form of the interaction, and the existence of a charge symmetry operation are generalized to other strong interactions. It is shown that the minimal conditions for the derivation of such results are the existence of a doublet structure for baryons and invariance under certain transpositions of the baryons that may be interpreted as generalized charge symmetries relating the different doublets and may be represented by reflection operations in an internal 4-dimensional space. If charge independence is also valid, highly symmetrical Yukawa couplings are obtained. The problem of the disagreement with experiment of such symmetric structures is analyzed in terms of additional quadrilinear interactions with lower symmetries which also possess the property that P invariance follows from invariance under CP. Various examples of such interactions are given. The possible application of the approximate symmetry principles considered to the weak interactions is briefly indicated. (auth)

18602

SHELL EFFECTS AT HIGH EXCITATION ENERGIES. H. W. Newson and M. M. Duncan (Duke Univ., Durham, N. C.). Phys. Rev. Letters 3, 45-6(1959) July 1.

It has been known for some time that a plot of the level spacings of rather highly excited compound nuclei fluctuates rapidly as a function of mass number. The fluctuations are evidently connected in some manner with the shell structure of nuclei since prominent maxima of the level spacings appear at neutron numbers of 50, 82, and 126. Rosenzweig has calculated relative shell-model level densities. Similar calculations are presented based on an even simpler model. An attempt is made to account for level spacings of even-A compound nuclei by considering the most significant mode of excitation of compound nuclei to be excitations of 0^+ pairs of like nucleons among the levels of a spherical shell-model scheme. (W.D.M.)

18603

CONSEQUENCES OF ATOMIC CONVERSION FOR THE INTERPRETATION OF EXPERIMENTS ON THE SPIN-DEPENDENCE OF MUON ABSORPTION. V. L. Telegdi (Univ. of Chicago). Phys. Rev. Letters 3, 59-61(1959) July 1.

The ground state of a μ-mesonic atom of non-zero nuclear spin I is split by the hyperfine interaction into two states, of total angular momenta $F = I \pm \frac{1}{2}$. Following a discussion and a suggested experiment by Bernstein, Lee, Yang, and Primakoff, the experimental consequences of atomic conversion processes are explored which may not be negligible in situations of actual physical interest. (W.D.M.)

18604

S-MATRIX POLES IN THE DETERMINATION OF PARITIES. G. Feldman and T. Fulton (John Hopkins Univ., Baltimore). Phys. Rev. Letters 3, 64-6(1959) July 1.

Recently it has been conjectured that there exist dispersion relations in momentum transfer variables. It has been suggested that an approximation to these relations could be used in order to determine such physical quantities as parities, coupling constants, etc. This approximation consists of extracting the contribution of certain single-particle intermediate states to S-matrix elements, and analyzing the experimental data on the assumption that these contributions pre-

dominate. Some potential difficulties inherent in such an analysis are pointed out. (W.D.M.)

18605

COMPENSATIONS IN ELECTRON EXCITATION EFFECTS IN p-p AND p-n SCATTERING. M. deWit, C. R. Fischer, and W. Zickendraht (Yale Univ., New Haven). Proc. Natl. Acad. Sci. U. S. 45, 1047-52(1959) July.

The possibility of the presence of modification in low-energy p-p and p-n scattering due to quantum mechanical corrections to the excitation effects has been suggested. On the other hand, it was pointed out that the shortness of the proton and neutron wave lengths in the high-energy experiments must produce agreement with classical treatment and therefore the classical mechanics type of compensation of elastic by inelastic processes. An account is given of calculations for monopole, dipole, and quadrupole Coulomb excitation. These were carried out according to the same general plan as that used by Breit. (W.D.M.)

18606

ON THE THEORY OF SUPERFLUIDITY OF A FERMI SYSTEM WITH ISOTOPIC SPIN. Yu. V. Tsekhmistrenko (Inst. of Physics Academy of Sciences, Ukrainian S.S.R.). Ukrain. Fiz. Zhur. 4, 39-45(1959) Jan.-Feb. (In Ukrainian)

Bogoliyubov's method of "distribution functions" is applied to the calculation of the energy of the ground state and the energy of elementary excitations of "nuclear matter" with an arbitrary central interaction among the nucleons, on the condition that the number of protons differs from the number of neutrons. Regardless of the smallness of the coupling constant, the interaction between the neutrons and protons proves ineffective for superfluid states. (auth)

18607

PHASE SPACE DIFFUSION EQUATION FOR NONLINEAR SYSTEMS. V. B. Magalinskii and Ya. P. Terletskii (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1731-5(1959) June. (In Russian)

The technique developed previously on the basis of Gibb's method is extended to the case of diffusion in phase space. The general space-velocity equation of motion for the probability density is derived only on the basis of general statistical mechanics principles and of assumptions regarding the form of the averaged equation of motion of the system. In the particular case of a linear friction law this equation coincides with the familiar space-velocity Einstein—Fokker—Planck equation. A general solution of the diffusion equation thus obtained is derived for a system in a uniform external field which possesses a nonlinear force of friction independent of the coördinates. (auth)

18608

RECONSTRUCTION OF THE POTENTIAL NEAR ITS BOUNDARY ON BASIS OF THE SCATTERING AMPLITUDE. A. G. Chicherin. Zhur. Eksptl'. i Teoret. Fiz. 36, 1750-57(1959) June. (In Russian)

The "asymptotic Born approximation" is set up on the basis of the scattering amplitude for a potential which coincides with the true potential at sufficiently large radii. The order of magnitude of the relative error in determination of the scattering potential at a point r is $\int U(r')r'dr'$. The case is considered when the scattering amplitude is prescribed in a finite energy interval. (auth)

18609

CYLINDRICAL AND PLANE MAGNETOHYDRODYNAMIC WAVES. K. P. Stanyukovich (Bauman Higher Tech. School). Zhur. Eksptl'. i Teoret. Fiz. 36, 1782-7 (1959) June. (In Russian)

Cylindrical waves produced in a conducting medium by a magnetic field are considered. The two cases when the field is directed along the Z axis and along the angle φ are analyzed. Special attention is paid to "sound" waves as well as to those possessing velocities close to that of light. (auth)

18610

ENERGY LEVELS AND APPROXIMATE WAVE FUNCTIONS OF MESIC ATOMS. G. E. Pustovalov (Moscow State Univ.). Zhur. Eksptl'. i Teoret Fiz. 36, 1806-17 (1959) June. (In Russian)

The energies of the 1S, 2S, 3S, 2P, and 3P levels of mesic atoms are computed in the nonrelativistic approximation under the assumption of a uniform nuclear charge density distribution within a sphere of radius R. By numerical solution of the Schroedinger equation, formulas are deduced for the dependence of the quantum defect Δn on $t = R_0Z/a_\mu$ (a_μ is the Bohr radius of the meson orbit). Approximate wave functions of the corresponding states are presented. It is shown how relativistic corrections and level shifts due to change of the shape of the nuclear charged distribution can be found by employing these wave functions and perturbation theory. (auth)

18611

THREE-PROTON ANNIHILATION OF POSITRONIUM IN THE P-STATE. A. I. Alekseev (Moscow Engineering and Physics Inst.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1839-44(1959) June. (In Russian)

A relativistically invariant expression for the probability amplitudes of three-photon annihilation of positronium was obtained by summation of an infinite number of graphs of a definite class. The probability for three-photon annihilation of positronium in the P-state is calculated in the nonrelativistic limit and the selection rules for this process are found. (auth)

18612

ON THE THEORY OF RELATIVISTIC MAGNETOHYDRODYNAMIC WAVES. I. A. Akhiezer and R. V. Polovin (Inst. of Physics and Tech., Academy of Sciences, Ukrainian, S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1845-52(1959) June. (In Russian)

One-dimensional simple waves in relativistic magnetohydrodynamics and relativistic hydromagnetic discontinuities (contact, tangential, Alfven, fast, and slow shock waves) are considered. The Zemplen theorem is proved for shock waves of arbitrary intensity. (auth)

18613

ON THE THEORY OF SCATTERING VIA QUASISTATIONARY STATES. V. I. Serdobolskii (P. N. Lebedev Physics Inst., Academy of Sciences, S.S.S.R.). Zhur. Eksptl'. i Teoret. Fiz. 36, 1903-8(1959) June. (In Russian)

A continuous spectrum wave function which describes S scattering is expanded in a series in terms of a set of quasistationary wave functions with complex energy. The validity of the expansion is demonstrated by investigating the analytical properties of the solution. The dispersion formulas obtained are somewhat more convenient for expressing the dependence of the cross section on energy than are those in previous theories. (auth)

18614
LE PROBLÈME À N CORPS. (The Many Body Problem). New York, John Wiley & Sons, Inc., 1959. 687p.

Lectures from the Summer School of Theoretical Physics of the University of Grenoble are presented. Topics covered include perturbation theory of many fermion systems, theory of nuclear structure, applications of the theory of many body systems, progress in the theory of nuclear matter, collisions in a Fermi gas, nuclear structures, properties of nuclear matter, statistical properties of nuclei, properties of collective motion in particle systems, degrees of freedom in nuclear models, Bogoliubov canonical transformation method, general theory of collective coördinates, electrons, plasmons, and phonons, superconductivity, liquid helium, hard-sphere Bose gas, and the method of binary collision expansion of Lee and Yang. (W.D.M.)

RADIATION EFFECTS ON MATERIALS

18615 AD-212502
Stevens Inst. of Tech., Hoboken, N. J.
UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF RADIATION TO ELECTRON TUBE MATERIALS. Quarterly Report Period, December 1, 1957 to February 28, 1958. E. R. Johnson. 17p. DA Project No. 3-99-13-000. Contract DA-36-039-SC-73146.

An experimental study on radiation damage to the glass used in electron tube manufacture has begun. An estimate of the probable induced radiation in materials found in electron tubes, at a distance of $3\frac{1}{2}$ miles from a 20 megaton burst, is given. Additional information is presented to support the previous view that ceramics formed under high temperatures are very resistant to radiation damage. (auth)

18616 AERE-C/R-1450
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE OXIDATION OF GRAPHITE DURING IRRADIATION IN OXYGEN. P. C. Davidge, M. Tomlimson, and J. Wright. Apr. 1959. 81p. $1.54(BIS).

The apparatus and procedure are described which were used to measure rapidly very low rates of CO_2 evolution from samples of reactor graphite oxidizing at 60 to 300°C during irradiation ($\sim 2 \times 10^{12}$ neut $cm^{-2}sec^{-1}$) in a stream of oxygen in the reactor BEPO. The normal thermal oxidation rate measured outside the reactor, at 300°C, by means of the CO_2 produced was equivalent to 0.59% weight loss per 1000 days, which agrees with past measurements of weight loss at higher temperatures. There were indications that at this temperature the thermal oxidation rate was enhanced by about 1 order of magnitude as a result of previous irradiation to about 2×10^{19} neut cm^{-2}, either as a direct consequence of radiation damage to the graphite, or as a sequel to other radiation induced reactions. At lower temperatures, thermal oxidation rates, whether enhanced through previous irradiation or not, were negligible in comparison to radiation induced reactions of a completely different nature. The rates of CO_2 evolution during irradiation showed a complex dependence upon the oxygen pressure, flow and the volume of the irradiated gas space upstream of the graphite. The results were interpreted in terms of the radiolysis of oxygen to form ozone, partial reversion of ozone to oxygen and the attack of residual ozone on the graphite. (auth)

18617 AERE-R-2863
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ROLE OF VACANCIES AND DISLOCATIONS IN THE NUCLEATION AND GROWTH OF GAS BUBBLES IN IRRADIATED FISSILE MATERIAL. G. W. Greenwood, A. J. E. Foreman, and D. E. Rimmer. Apr. 1959. 49p.

It is shown that fine-scale bubbles are to be expected in reasonably pure uranium, the bubbles nucleating either homogeneously with a spacing less than a micron or on any suitable nucleation sites that may exist on this or a finer scale. The precise value of the homogeneous nucleation spacing depends on the diffusion coefficient of the gas atoms, which is modified during irradiation by the excess concentration of vacancies produced by the fission process. The dislocation lines and nodes should provide suitable nucleation sites as they have about the right spacing and their stress fields should attract the large inert gas atoms to form Cottrell atmospheres. The bubbles when once nucleated grow by a vacancy diffusion mechanism, the vacancies being created by the fission process or possibly diffusing from the grain boundaries in very small grains. At temperatures above some value, which in certain cases may be as low as about 300°C, the influx of vacancies is sufficient to prevent the gas pressure in a bubble from exceeding the surface energy restraining force by more than an order of magnitude, in which case dislocation mechanisms of plastic deformation should not operate. The fission process enhances the concentrations of both vacancies and interstitials in the solid with the result that bubble growth is governed by the thermal equilibrium of vacancies, but an enhanced growth will occur at the lower temperatures if the sinks for point defects accept interstitials more readily than they do vacancies. (auth)

18618 ANL-5988
Argonne National Lab., Lemont, Ill.
THE PERFORMANCE OF A SPECIAL DIFFERENTIAL TRANSFORMER AND AN EDDY CURRENT COIL IN A HIGH GAMMA FLUX ENVIRONMENT. George J. Pokorny and James E. Ayer. July 1959. 19p. Contract W-31-109-eng-38. $0.50(OTS).

The gamma activity anticipated during the refabrication of EBR-II fuel has rendered suspect many operations considered adequate in less demanding environments. Two such operations involve the use of a differential transformer to measure linear displacement and an eddy current coil to measure the internal integrity of a cast fuel pin. A test apparatus containing the above components was irradiated at between 4.7×10^5 and 1.6×10^6 rad/hr in the ANL Gamma Irradiation Facility. The electrical output of the components was periodically monitored until a total exposure of 1.24×10^9 rads had been realized. No changes in the shape of the traces recorded were noted over the entire irradiation period. With the exception of a base-line shift in the case of the eddy current output trace, the measurements were also insensitive to temperature changes of the order of 19°C. Radiation damage to paints, varnishes, conventional insulations and a radiation-resistant grease was noted, but the extent of this effect

was not such that the test was affected. It appeared that the performances of the linear transducer and eddy current device were such that they would be expected to operate successfully in an environment similar to that anticipated in the EBR-II Fuel Cycle Facility. (auth)

18619 CF-58-8-35
Oak Ridge National Lab., Tenn.
METALLOGRAPHIC EXAMINATION OF IRRADIATED CERMET FUEL ELEMENTS. Report No. 6. A. E. Richt. Aug. 4, 1958. 9p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Cr–Al_2O_3 cermet specimens were examined by metallographic methods. Two unfueled specimens were previously irradiated in the LITR to about 10^{20} nvt (thermal), and two UO_2 fueled specimens were irradiated to 2.53×10^{20} nvt at 1000°C. The unfueled samples showed no evidence of structural changes as a result of irradiation. Various changes in the fueled sample are discussed. (J.R.D.)

18620 CRMet-821
Atomic Energy of Canada Ltd., Chalk River, Ont.
IRRADIATION EFFECTS IN SUPER PURITY ALUMINUM MAGNESIUM ALLOYS. G. R. Piercy. Apr. 1959. 35p. (AECL-810). $1.00(AECL).

The tensile properties of annealed samples of aluminum–magnesium alloys containing 0.001 to 2.8 wt. % magnesium have been determined in the irradiated and unirradiated condition. The increase in elastic limit caused by reactor irradiation is shown by two effects, an increase proportional to the integrated fast-neutron flux that is greater for alloys of lower magnesium content, and an additional increase that only occurs for the intermediate compositions 0.5 and 1.0% Mg and reaches its maximum value with an integrated flux less than 6×10^{19} neutrons/cm^2. The recovery of the increase in elastic limit caused by irradiation occurs in two stages for super purity aluminum. The first near 120°C requires an activation energy of 0.9 ev while the second at 160°C requires 1.7 ev. Recovery for the alloys is in one stage at 200°C and it requires an activation energy of 2.4 ev. The mechanical properties of a 1% Mg alloy were unchanged by 6×10^{19} fast neutrons per square centimeter, if the alloy had been previously cold rolled to 90% reduction. The initial recovery of these cold-worked samples however, required an activation energy of 2.2 ev for the irradiated sample but only 1.2 ev for the unirradiated sample. The recovery results are interpreted in terms of magnesium-vacancy pairs agglomerating and forming stacking faults with a high magnesium concentration at the fault. (auth)

18621 KAPL-M-WEM-1
Knolls Atomic Power Lab., Schenectady, N. Y.
GAMMA ACTIVITY INDUCED IN Bi_2Te_3 BY THERMAL NEUTRONS. W. E. Moore. June 17, 1959. 17p. Contract W-31-109-Eng-52. $3.30(ph), $2.40(mf) OTS.

The γ-ray spectrum was obtained from a neutron-irradiated sample of p-type Bi_2Te_3, using standard scintillation counting techniques. The energies and half lives were determined for several of the γ rays. The most important decaying nuclides are identified as I^{131} (8.1 d) and Te^{131m} (30 h). These identifications permit calculation of the specific activity (per unit weight and unit flux) expected from a Bi_2Te_3 sample as a function of time, for irradiation times of 30 and 300 hr. This calculation provides a basis for an estimate of the radiation hazard and shielding requirements for subsequent irradiation experiments. The results are shown to apply equally well to n-type Bi_2Te_3 and to n- and p-type PbTe. (auth)

18622 NP-7728
Massachusetts Inst. of Tech., Cambridge.
PROCUREMENT OF SERVICES PERTINENT TO THE DETERMINATION OF BACTERIAL RESISTANCE OF PACKAGES. Report No. 9 (Final) [for] Period September 26, 1956–March 25, 1958. B. E. Proctor. 36p. Project No. 7-84-01-002. Contract DA-19-129-QM-758.

A variety of food packaging materials was evaluated for their ability to withstand bacterial penetration. The effects of irradiation on the frequency of bacterial penetration were also investigated. Data are tabulated. (C.H.)

18623 NP-7729
Crown Zellerbach Corp. Western-Waxide Div., San Leandro, Calif.
INVESTIGATION OF THE EFFECTS OF RADIATION ON WAXES AND WAX COATED PAPER PRODUCTS. Report No. 4 (Final) [for] September 23, 1957–September 22, 1958. J. E. Smith. 21p. Project No. 7-84-01-002. Contract QMR&E (Natick) No. 92 (Agreement).

Various waxes, wax blends, and waxed papers were irradiated to levels of 0.05×10^6, 0.5×10^6, 1.0×10^6, and 5.0×10^6 reps. Decreases in waxed paper strength properties resulted. Wax blends which contained polyethylene and butyl rubber exhibited increased viscosities at higher dosage levels. Other changes in unmodified waxes and wax blends were negligible. No increasing effects due to irradiation occurred upon storage of samples for up to six months. (auth)

18624 NP-7731
Rhinelander Paper Co., Rhinelander, Wis.
PAPERBOARD CONTAINERS FOR IRRADIATED FOODS. Report No. 1 (Final) [for] June 28, 1957 to June 27, 1958. R. C. Crain. 7p. Project No. 7-84-01-002, Contract QMR&E (Natick) No. 86 (Agreement).

Samples of glassine paper, nitrocellulose lacquer coated glassine paper, waxed glassine paper, and wax laminated glassine paper were subjected to irradiation from a 2 million volt electron beam generator at dosage levels of 75,000, 500,000, and 5,000,000 rad. Bursting strength and tearing resistance of all samples were essentially unaffected at the two lower dosage levels. At 5×10^6 rad, these properties decreased slightly. Strength of heat seals was not changed by irradiation. Moisture vapor permeability of lacquer coated glassine was not changed by irradiation; that of waxed glassine was decreased slightly; that of wax laminated glassine was unaffected at lower dosages, and increased slightly at 5×10^6 rad, probably because of visible blistering of the wax. The color of dyed papers was adversely affected at 5×10^6 rad. (auth)

18625 UKE-CR-704
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
EXAMINATION OF URANIUM OXIDE SPECIMENS FROM THE FOURTH CHARGE OF THE EEC LOOP. A. S. Bain and R. D. MacDonald. June 1958. 13p.

Results of examinations of seven UO_2 specimens irradiated in the EEC loop are presented. Reactor conditions during the test are tabulated. It was concluded that the maximum temperatures inside the fuel elements were lower than those calculated using a simple model.

Concentric rings in the $UO_{2.285}$ specimens were thought to be associated with some specific temperature, their positions being related to three power levels at which the reactor operated during the test. The mechanism for their formation can not be determined from the available information. (J.R.D.)

18626 WAPD-P-95

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

A GUIDE TO THE EFFECTS OF GAMMA IRRADIATION ON THE PROPERTIES OF NON-METALS. W. L. Lawrence and S. Mayburg. July 16, 1951. Decl. Oct. 14, 1958. 16p. Contract AT-11-1-GEN-14. $3.30(ph), $2.40(mf) OTS.

The effects of radiation on the dielectric strength, resistivity, and insulation resistance of plastics, electric insulators, and organic compounds are tabulated as a guide in selecting materials for use under gamma radiation. (J.E.D.)

18627

RADIATION EFFECTS ON CERAMIC MATERIALS. Jozsef Zömbik. Energia és Atomtech. 11, 644-7(1958) Sept.-Oct. (In Hungarian)

Irradiation effects on nonmetallic materials are reviewed and correlated with the effects on ionic and covalent types of chemical bonds and with radiation-induced lattice defects and temperature annealing phenomena. High-temperature irradiation experiments are suggested in order to evaluate the usability of ceramics as structural materials in nuclear power plants. (R.V.J.)

18628

RADIATION EFFECTS IN SILICON SOLAR CELLS. F. A. Junga and G. M. Enslow (Lockheed Missile and Space Div., Palo Alto, Calif.). IRE Trans. Nuclear Sci. NS-6, 49-53(1959) June.

Calculations have been performed to estimate the number of atoms displaced from normal sites by Compton Electrons from Co^{60} gamma rays and by slow and fast neutrons. The resultant change in carrier lifetimes and mobilities are used to predict the performance of a silicon solar cell under gamma and neutron irradiation. The effect of annealing of defects is considered, and from these computations an estimate is made to show the minimum flux necessary to produce noticeable damage. Data are presented showing the effects of Co^{60} gamma rays on 10 silicon solar cells and comparison is made with the theory. (auth)

18629

SILICA–URANIUM FUEL SYSTEMS. W. M. Cashin (General Electric Co., Schenectady N. Y.). J. Am. Ceram. Soc. 42, 328-9(1959) July.

Presented are the irradiation results on two uranium–silica systems: a uranium oxide–Vycor-brand glass system and a 10% uranium oxide glass prepared by melting. The glasses were irradiated up to 15% depletion of the uranium at temperatures up to the softening points with no appreciable loss of fission-product gases. Included is an outline of a procedure for impregnating leached, unfired Vycor-brand glass with uranium. Rare gas release from specimens is discussed. (auth)

18630

RADIATION EFFECTS ON SOLIDS, INCLUDING CATALYSTS. Eilison H. Taylor (Oak Ridge National Lab., Tenn.). J. Chem. Educ. 36, 396-407(1959) Aug.

Resistance, damage, and ionization effects due to irradiation of solids are discussed in relation to various solids. Alterations of solids by radiolytic reactions in liquids, by simultaneous irradiation, and by influence of prior irradiation are briefly presented. Influence of prior irradiation upon catalytic activity is described in detail. (C.J.G.)

18631

RADIATION DAMAGE IN FERROUS METALS. D. E. Thomas (Westinghouse Electric Corp., Pittsburgh). J. Metals 11, 523-7(1959) Aug.

In iron and ferrous materials, irradiation increases strength and decreases ductility. Yield stress, in general, is increased proportionately more than the ultimate stress, accompanied by a reduced strain-hardening capacity and decreased uniform elongation. In stainless steels, property changes generally appear to saturate at total exposure of 10^{19} or 10^{20} nvt. Effects of irradiation on various low-alloy steels are presented. (C.J.G.)

18632

EFFECT OF IRRADIATION ON FUEL MATERIALS. PART II. J. H. Kittel and S. H. Paine (Argonne National Lab., Lemont). Nuclear Energy Engr., 357-60(1959) July.

Unalloyed uranium with suitable metallurgical treatment can be subjected to burnups of 2 at.%. Damage is severe. Deleterious changes occurring at moderate irradiation temperatures are principally due to surface roughing and anisotropic growth. Certain alloying conditions greatly refined the grain size in uranium, thus eliminating surface roughening. Alloying conditions can alter the transformation kinetics of uranium so that preferred orientation resulting from fabrication procedures may be largely removed by heat treatment. For alpha-phase alloys, these heat treatments usually consist of holding the material briefly in the gamma phase, followed by an extended isothermal anneal to permit the alloy to transform completely to alpha. For alloys retaining the gamma phase on cooling, the preferred heat treatment is usually a quench from the gamma phase, which may be preceded by a homogenizing anneal at gamma temperatures. Both uranium and uranium-base alloys show definite irradiation temperature limitations, above which swelling occurs. Thorium and thorium–uranium alloys show dimensional stabilities which are superior to those shown by the metallic uranium fuels. Oxide fuels are characterized by even better stability under irradiation. Pellets of ThO_2 with additions of UO_2 show negligible dimensional changes after burnups on the order of 1% of the metal atoms with central temperatures of 2,000°C or more during irradiation. (C.J.G.)

18633

STORED ENERGY OF IRRADIATED COPPER. T. H. Blewitt, R. R. Coltman, and C. E. Klabunde (Oak Ridge National Lab., Tenn.). Phys. Rev. Letters 3, 132-4 (1959) Aug. 1.

In the past three years several measurements of the stored energy of irradiated copper have been made, and it has been estimated from these measurements that the most reliable figure was 2×10^{-1} cal/mole released following a dose of 4×10^{17} n/cm^2. These measurements were repeated under more favorable circumstances, and the results are described. (W.D.M.)

18634

PRODUCTION OF EXTREMELY HIGH LATTICE DEFECT CONCENTRATION IN THE IRRADIATION OF SOLID BODIES IN REACTORS. Nikolaus Riehl and Rudolf Sizmann (Technische Physik der TH, Munich). Z. angew. Phys. 11, 202-7(1959) June. (In German)

Extremely high lattice-defect concentrations can be produced in solids by covering both sides of a foil of the solid with a thin layer of B^{10} or Li^6 and irradiating the specimen with slow neutrons in a reactor. Each of the slow neutrons absorbed in the B^{10} layer produces an alpha particle and a Li^7 recoil particle which pass through the material to be investigated. (In a Li^6 layer, alpha and H^3 particles are produced.) In this irradiation method the density of Frenkel defects is higher by a power of ten than the density produced in a fast neutron flux. The efficiency of this method was tested with a copper foil covered with B^{10}. The Frenkel defects were determined by a measurement of the electrical resistance. The highest density of defects was obtained in a copper foil traversed by Li^7 particles and having a thickness of approximately 0.84 μ. With the use of a Li^6 layer, a copper foil of 30μ thickness is possible because of the greater range of H^3 particles. With this method effects can be produced with a relatively weak neutron source which otherwise would require a materials testing reactor. (tr-auth)

RADIOACTIVE WASTE

18635 HW-58126

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CORROSION FILM REMOVAL AS AN INDICATION OF DECONTAMINATION EFFECTIVENESS. R. D. Weed. Nov. 10, 1958. 20p. Contract AT(45-1)-1350. $3.30 (ph), $2.40(mf) OTS.

The decontamination of high-temperature, high-pressure recirculation loops and components is being investigated. The Turco-4501 process and certain promising modifications of this process are being evaluated according to their film-removing qualities. Two of the processes exhibited more promise than others. These were the Turco-4501 process, substituting either oxalic acid or a chromic acid solution for the nitric acid. Other variations were also tested and results are reported. (W.L.H.)

18636 RDB(W)-8021

Gt. Brit. Windscale Works, Sellafield, Cumb., England.

FACTORS AFFECTING THE DISSIPATION OF WINDSCALE RADIOACTIVE EFFLUENT IN THE IRISH SEA. A. E. Shaw and F. R. Charlesworth. Feb. 20, 1952. 42p.

The dissipation of effluent into sea water by initial dilution, eddy diffusion and residual currents, was originally assessed by Seligman and Scott in 1948. Further experimental work is described which has enabled a new assessment to be made. This work has included a measurement of the initial dilution of fresh water from the pipe line, and a study of the movement of water as indicated by drift bottles. It is now envisaged that initial dilution, by a factor of 10^4, will be followed by eddy diffusion with the coefficients as measured by Seligman and bulk movement primarily due to the force of the wind. Exceptions will occur when defined calm conditions exist. The discharged effluent will then tend to float on the surface with an initial dilution factor of only a few hundred and successive tidal releases will pour into the diffusing remains of the previous activity, there being no indications of residual currents. No work has been done to see if this more concentrated effluent can come ashore without further dilution. It is recommended that, to avoid floating effluent, water should not be discharged during very calm weather. Maximum storage space can be assured by normally pumping effluent to sea at the next high tide after treatment. (auth)

18637

PRELIMINARY TESTS ON CLAY SINTERS TO RETAIN REACTOR WASTES. J. M. Kerr (Oak Ridge National Lab., Tenn.). Am. Ceram. Soc. Bull. 38, 374-6(1959) July.

The primary object of this investigation was to study the fixation of radioisotopes by clays and other fine grained naturally occurring materials. By progressively decreasing the amount of clay added to a given amount of waste solution tagged to a given activity, the minimum amount of clay necessary to retain the activity was determined. Mixes which gave the best results consisted of 100 g of shale with fluxes, 50 g of phosphate slime, and 50 g of a processed attapulgite clay, each with 250 ml of a simulated waste solution. The waste solution used in these investigations consisted of 1.6 M $Al(NO_3)_3$, 0.16 M HNO_3, 0.02 M H_2SO_4, mixed fission products, and carriers. Relatively high activity levels in the simulated waste solution were used in several mixes and indications were that increased firing temperatures would be necessary to retain the higher activity. These relatively high-activity levels were in the range of 200,000 to 400,000 beta counts/min/ml. Flux additions were made to an attapulgite clay and aluminum nitrate solution mixture. Results show that various fluorides will materially reduce the fusion temperature. (auth)

18638

MODERN METHODS FOR THE CONCENTRATION, NEUTRALIZATION, AND STORAGE OF RADIOACTIVE WASTES. [PART] I. Viktor Iwanowitsch Spitsyn (Akademie der Wissenschaften der UdSSR, Moscow). Prak. Chem. 10, 86, 88, 91-6, 98(1959). (In German)

A review is presented on the methods used by various nuclear energy installations to process and store radioactive wastes. The chief fission products and the sources of waste are discussed. The processing of both liquid and solid wastes is considered. (J.S.R.)

18639

MODERN METHODS FOR THE CONCENTRATION, NEUTRALIZATION, AND STORAGE OF RADIOACTIVE WASTE. II. Viktor Iwanowitsch Spitsyn (Mitglied der Akademie der Wissenschaften der UdSSR, Moscow). Prak. Chem. 10, 128, 130, 133-4 (1959) Apr. (In German)

The review of the methods used by various nuclear energy installations to process and store radioactive wastes is concluded. The results of studies on the absorption of fission products by the soil are reported. Radioactive gases and aerosols are briefly discussed. 36 references. (J.S.R.)

REACTORS

General

18640 AAEC/E-14

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

A PRELIMINARY KINETIC STUDY OF A SODIUM–BERYLLIUM–URANIUM CIRCULATING FUEL REACTOR. J. J. Thompson. Nov. 1956. 11p.

The initial response of a 1:100:2000 U–Na–Be

reactor, operating at a power density of 1200 cals/cc/sec, to a sudden change in the fuel concentration in the circulating carrier, was calculated on the assumption of constant inlet temperature and no delayed neutrons. The results confirm that the peak temperatures and power can be accurately calculated by ignoring the moderator temperature rise, and that the approach to the new steady state values is given by the solution of the linearized equations. The slow moderator heating implies that the departures from the steady state are still large when the carrier and fuel have completed one transit of the external circuit. The assumption that the mean temperature is the arithmetic mean of inlet and outlet temperatures very nearly gives the true mean temperature peak but overestimates the maximum power and outlet temperature excursions by 15½ and 7%, respectively. (auth)

18641 AAEC/E-30

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.

A NOTE ON THE RESPONSE OF A CIRCULATING FUEL REACTOR TO RANDOM FLUCTUATION IN UEL CONCENTRATION. J. J. Thompson. Nov. 1956. 9p.

A simplified model of a uranium–sodium–beryllium circulating fuel reactor was analyzed to determine the root mean square power and temperature fluctuations due to random variations in the inlet fuel concentration. The results indicate that limits of ±2% on the fuel concentration should reduce the mean square power excursion, due to this cause, to less than ½%. The calculations are based on assumptions only, as regards the specification of the statistical nature of the fuel concentration, but the method can be used to obtain more realistic estimates when experimental evidence becomes available. (auth)

18642 ACPP/P-43

Gt. Brit. Div. of Atomic Energy (Production), Risley, Lancs, England.

AIR COOLED PRODUCTION PILE PERFORMANCE ESTIMATE. H. S. Arms and H. H. Gott. Nov. 24, 1948. 8p.

The engineering factors influencing the performance of the Production Piles are discussed in general terms in an effort to summarize the likely causes of variation from predicted performance. (auth)

18643 AEEW-M-4

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Establishment, Winfrith Heath, Dorset, England.

AN INTERIM REPORT ON THE ZENITH EXPONENTIAL EXPERIMENTS. R. M. Absalom, I. R. Cameron, G. H. Kinchin, J. E. Sanders, and D. J. Wilson. June 1959. 14p. $0.35(BIS).

An interim account of the exponential experiments with Zenith-type fuel elements being carried out at Winfrith is presented. The measurements are being undertaken in order to form some initial understanding of the reactor physics of U^{235}–Th–graphite systems. (W.L.H.)

18644 AERE-R-2933

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME OBSERVATIONS ON THE EXTRACTION OF NITRIC ACID, URANIUM AND PLUTONIUM BY TRI-ISONONYLAMINE. U. Bertocci. May 1959. 17p.

The extraction of nitric acid, nitrous acid, and U and Pu nitrates from acidic solutions using tri-isononylamine (TNA) in xylene as extractant was studied. Some experiments were also done on the back extraction of Pu from the organic phase by reduction to the trivalent state. (auth)

18645 ANL-5974

Argonne National Lab., Lemont, Ill.

IGNITION BEHAVIOR AND KINETICS OF OXIDATION OF THE REACTOR METALS, URANIUM, ZIRCONIUM, PLUTONIUM, AND THORIUM, AND BINARY ALLOYS OF EACH. A Status Report. J. G. Schnizlein, P. J. Pizzolato, H. A. Porte, J. D. Bingle, D. F. Fischer, L. W. Mishler, and R. C. Vogel. April 1959. 207p. Contract W-31-109-eng-38. $3.50(OTS).

The importance of prevention of fires and explosions involving uranium, zirconium, plutonium, and thorium, which are of particular interest to the nuclear energy program, made imperative the study of their ignition behavior and oxidation kinetics. Methods of measurements of ignition characteristics of uranium and zirconium were developed and used to determine the effects of variables, such as surface preparation, metallurgical history, specific area (sample size), additives to the metal, and oxygen content and presence of moisture in the oxidizing gas. The study of ignition characteristics was supported by study of the effects of similar variables on the kinetics of oxidation of uranium and zirconium and binary alloys of each. The oxidation of uranium always proceeded in two linear stages over the temperature range of 125 to 295°C at pressures of 20, 50, 200, and 800 mm of oxygen. The temperature dependences of both stages indicate an activation energy dependent on pressure. The presence of ten additive elements in uranium metal caused only very small effects on the oxidation. The oxidation of zirconium was independent of pressure and proceeded according to a cubic rate law over the temperature range from 400 to 900°C, with an activation energy of 42.7 kcal per mole. For those additives soluble in zirconium at 700°C, the effects on the initial cubic rate law for oxidation are explained in terms of valency according to the Wagner-Hauffe Theory. For those additives insoluble in alpha zirconium, no single theory is felt to be adequate. The breakaway phenomena observed for many of the twenty alloys is explained in terms of a 15 per cent deviation of the additive ionic radius from the ionic radius of zirconium. Surveys of the literature on the oxidation of plutonium and thorium are presented in preparation for the study of their behavior. (auth)

18646 CF-59-6-90

Oak Ridge National Lab., Tenn.

LECTURE NOTES ON REACTOR CONTROLS. C. S. Walker. June 24, 1959. 182p. Contract [W-7405-eng-26]. $28.80(ph), $8.40(mf) OTS.

This material is the outgrowth of the notes prepared for lectures on reactor controls given in 1953-55 at the Oak Ridge School of Reactor Technology. The course on reactor controls was for the purpose of acquainting the student with some of the elementary considerations involved in setting up a control and safety system for a nuclear reactor. Topics are discussed on kinetics, neutron energies, poisoning, analog computing, instrumentation, start-up, neutron sources, etc. (W.D.M.)

18647 CRBib-814

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A BIBLIOGRAPHY OF CANADIAN HEAVY WATER REACTOR TECHNOLOGY. S. J. Townsend. May 1959. 17p. (AECL-730). $0.50(AECL).

A bibliography on Canadian publications which report construction and operation of heavy water reactors from 1952 to the present is presented. 175 references. (J.R.D.)

18648 IDO-16512

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

QUARTERLY PROGRESS REPORT [FOR] JULY, AUGUST, SEPTEMBER 1958. G. O. Bright, ed. May 6, 1959. 72p. Contract AT(10-1)-205. $2.00 (OTS).

SPERT I: Most of the data obtained during experiments with "B" cores are presented in summary form. The effect of small (< 1 ft/sec) moderator flow rates was investigated. The critical experiment with the APPR core was completed; the effect of water height on control rod worth was determined. SPERT III: A new calculation was made to determine a value for the self-shielding effect in fuel plates. Tentative results for reactivity values and temperature coefficients were obtained from the IBM-704 program. THEORETICAL: A method of treating thermal shutdown effects in Spert I was developed using a two-term exponential form for describing the power burst in the calculation of the reactivity compensated at the time of peak power. Comparison with experiment shows good agreement, especially in the short period region. An analytic treatment of transient heat conduction during reactor power excursions is presented, and an application to moderator displacement calculations in the Spert A-17/28 core is shown. An approximate linear form which represents the non-linear expansivity of water with temperature was developed. ENGINEERING: Spert I reactor and plant modifications which were necessary for accommodation of the APPR core were completed. Design criteria for a pile oscillator were set and fabrication of the unit was completed. The status of Spert II component design and procurement is shown, with the plant estimated to be about 60% complete. An acceptance test was completed on the Spert III plant. Hydraulic tests conducted on several arrays of fuel assemblies and filler pieces indicate uniform flow distribution across the core is obtained. (For preceding period see IDO-16489.) (D.E.B.)

18649 IDO-16532

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

MTR-ETR TECHNICAL BRANCHES QUARTERLY REPORT FOR PERIOD ENDING DECEMBER 31, 1958. June 19, 1959. 66p. Contract AT(10-1)-205. $1.75 (OTS).

A summary of the more significant results of the work in progress in the technical branches of the Materials Testing Reactor—Engineering Test Reactor complex are presented. Measurements of horizontal and vertical statistical weights in the ETRC show that a calculated statistical weight proportional to the square of the neutron flux provides good correlation with the measured statistical weight in the vertical plane but only a rough estimate in the horizontal plane. An investigation into a proposed gamma-insensitive neutron detection system utilizing neutron activation of a chemical solution has shown that the system will provide stable operation for practical operating parameters in the control of a nuclear reactor. Calculations on the irradiation of thorium show that continuous irradiation is desirable for greatest production of U-233 for later separation. Measurements made with the crystal spectrometer and fast chopper include additional total and fission cross sections for U-233, transmission measurements on Np-237 and enriched Ir, total cross section of D_2O from 5.5 to 2,000 ev (complete), and studies of Be crystal thickness effects. Inelastic scattering data for steam, methane, and vanadium were taken at 90° for several incident neutron energies at 0.014 to 0.48 ev. A pulsed crystal oscillator was developed to increase accuracy of time-of-flight measurements. Preliminary nuclear chemistry results on Pu-239 indicate that the ratio of asymmetric to symmetric fission is much greater for fissions produced by 0.3 ev neutrons than for those produced by thermal neutrons. Effective cross section values obtained from observed yields from several irradiated Pu napkin rings were used to calculate the yield curves for high nvt Pu irradiations made in similar fluxes. The four MTR permanent-magnet β-ray spectrometers were calibrated to allow measurements accurate to 0.05%. Gamma-gamma directional correlation measurements for 3 in. by 3 in. NaI(Tl) crystals were made to determine the difference between the experimental and theoretical values caused by the finite angular resolution of the detectors. A method was developed that gives a good representation of local flux distributions in plate-type reactor fuel assemblies by use of expansions in half-range Legendre polynomials. Diffusion theory is an inadequate approximation for this calculation, and conventional expansion of the angular distribution in full range Legendre polynomials may require many terms. The half-range expansions often give good results with only a few terms. (For preceding period see IDO-16505.) (auth)

18650 IDO-16534

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REACTOR POWER TRANSIENTS AS CALCULATED BY THE SPACE INDEPENDENT REACTOR EQUATIONS. K. V. Moore and W. J. Byron. June 11, 1959. 20p. Contract AT(10-1)-205. $0.75(OTS).

A number of reactor power transients were calculated as a part of the ETR and MTR safety systems analysis. These calculations were performed on the IBM-650 digital computer by numerically integrating the basic non-linear space-independent reactor equations (with delayed neutrons). The transients are of two basic types: linear withdrawal of the control rods with a subsequent accelerated scram; and step reactivity insertion followed by an accelerated scram. As these calculations are primarily descriptions of hypothetical accident conditions, they must not be overly optimistic. Comparing identical transients, assuming the existence and non-existence of delayed neutrons, shows the desirability of using the more complex reactor equations as an aid to the establishment of safe operating limits. The energy release as calculated by assuming no delayed neutrons may be too small by as much as a factor of two. It should be noted that even though these calculations contain a small degree of sophistication, actual reactor transients may be quite different. Factors such as void and temperature coefficients, neutron energy spectrum, boiling, meltdown, etc., were not considered.

Many of these neglected effects operate as shutdown mechanics in the actual reactor; therefore, the magnitudes of the calculated overshoots are in error to some degree. The transient periods and reactor power are probably accurate below a value of about 2 n_f. (auth)

18651 IDO-16540

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

CORE POWER VARIATION AND FUEL BURNUP IN THE ENGINEERING TEST REACTOR. L. J. Harrison. July 8, 1959. 34p. Contract AT(10-1)-205. $1.00 (OTS).

Neutron flux measurements were made in the ETR before, during, and after the operation of two different cores. Data obtained from these measurements were used to calculate the per cent core power in each of the fuel assemblies and control rod fuel sections. These per cent values were in turn used to calculate the burnup of U-235. Tables of per cent core power values and burnup values are listed. These values illustrate the change during core operation in per cent core power in a particular location and the fuel burnup in this location. (auth)

18652 LA-2292

Los Alamos Scientific Lab., N. Mex.

LOS ALAMOS POWER REACTOR EXPERIMENT NUMBER ONE — LAPRE I. R. E. Peterson, ed. Jan. 1959. 139p. Contract W-7405-eng-36. $2.75(OTS).

The Los Alamos Power Reactor Experiment No. 1 consisted of two operational tests of a high temperature homogeneous reactor fueled with uranium (93.5% U^{235}) dissolved in H_3PO_4. The experiment was terminated following mechanically induced failures of the gold cladding used to protect the stainless steel heat exchanger surfaces against corrosion by the fuel solution. During the short period of operation preceding system failure the predicted recombination of O_2 and H_2 resulting from the dissociation of the aqueous fuel solution appears to have been demonstrated. Nuclear data obtained indicate that calculations made during the design of the reactor were in fair agreement with the observed behavior of the system. In addition to summarizing the data obtained during operation, several of the mechanical components, techniques, and design features developed during fabrication of the reactor systems are described and evaluated. (auth)

18653 MIT-OR-1

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

ACTIVATION OF PRIMARY COOLANT IN MOLTEN-SALT REACTOR. D. J. McGoff, M. P. Aronchick, P. L. Durrill, and R. A. Suehrstedt. July 30, 1959. 28p. For Oak Ridge National Lab., Contract W-7405-eng-26, Subcontract 70. $1.00(OTS).

Estimates were made of the neutron and gamma dose rates at the surface of the secondary heat exchanger of the proposed Molten Salt Reactor due to activation of the primary coolant. Two possible primary coolants were considered: liquid sodium and a molten solution of the fluorides of lithium and beryllium. It was found that no significant neutron currents exist at the heat exchanger surface if either coolant is used. Significant gamma currents exist, however, due to the gamma radiation accompanying the decay of Na^{24} or F^{20}. Estimates of the dose rates due to these currents are given. The results showed that if molten salt rather than sodium is used as coolant, lower initial activity will exist at the surface of the secondary heat exchanger and a shorter radioactive decay time will be required for the activity to drop to a safe level. (auth)

18654 MIT-OR-2

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

ADSORPTION OF BORON ON REACTOR SLURRY SOLIDS. D. W. Jeffrey and W. L. Brassert. July 30, 1959. 25p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 70. $0.75(OTS).

A study was made of the adsorption characteristics of boron, in the form of boric acid, on reactor slurry solids consisting of a solid solution of uranium and thorium oxides in an atom ratio of 0.10 uranium to thorium. When oxides fired at 1100°C were used, the ratio of boron concentration on the solids to boron concentration in the liquid was very much lower than for 650°C fired oxides at the same slurry temperature. If a slurry-type homogeneous reactor fueled with 1100°C-fired oxides of thorium-232 and uranium-233 is poisoned with boron prior to startup and the boron in the supernatant liquor subsequently removed, the neutron loss due to absorption of neutrons by adsorbed boron could quite possibly be small enough to permit breeding to take place during operation. (auth)

18655 MIT-OR-3

Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.

THE EFFECT OF LENGTH ON THE MAXIMUM POWER DENSITY IN A LONG, CYLINDRICAL REACTOR. G. K. Gardiner, M. P. Aronchick, and J. L. Sapir. Aug. 4, 1959. 28p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 70. $1.00 (OTS).

A study was performed to determine the relation between maximum power density and length for a long, cylindrical, homogeneous reactor, taking axial temperature gradients into account. Results indicate that if the total power and the temperature rise through the core are held constant, maximum power density decreases with increasing length; however, the rate of decrease becomes smaller as the length is increased. The maximum power density occurs at approximately the same distance from the reactor inlet, regardless of reactor length, and the average temperature of the core fluid rises as a reactor length is increased. Furthermore, the power density distribution in the reactor is independent of whether the reactor is either just-critical or super-critical. (auth)

18656 NAA-SR-3211

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

RESONANCE ESCAPE PROBABILITY OF A LATTICE OF MULTI-ROD FUEL ELEMENTS. C. H. Skeen and W. W. Brown. Aug. 1, 1959. 24p. Contract AT-11-1-GEN-8. $1.00(OTS).

The resonance escape probability of a square lattice of multi-rod uranium fuel elements in a graphite moderator was measured by activation techniques. The elements were spaced 9.5 inches apart, center to center. Each element consisted of seven fuel rods $\frac{3}{4}$ inches in diameter and 5 feet long containing 2.78 wt-% enriched uranium metal. The measured value of ρ is 0.809 ± 0.005. The corresponding value of the effective resonance integral for the element is 7.9 ± 0.3 barns. This value of the effective resonance integral is in agreement with the value obtained at other laboratories for

an element of the same surface-to-mass ratio. The results are also in agreement with the resonance integral obtained from an analysis of exponential experiments performed with lattices made up of these same elements. (auth)

18657 NP-7752

United Kingdom Atomic Energy Authority. [Industrial Group H. Q., Risley, Lancs, England].

EMERGENCY ORGANISATION AND REACTOR SITING. H. J. Dunster and F. R. Farmer. May 12, 1959. 7p.

Emergency organizations are considered in a general manner, but with particular attention to the functions of a health physics organization at a reactor site. (W.L.H.)

18658 ORNL-2753

Oak Ridge National Lab., Tenn.

DAREX PROCESSING OF APPR FUEL: EFFECT OF ACIDITY AND GAS SPARGING ON RATE OF CHLORIDE REMOVAL FROM DISSOLVER PRODUCT DURING REFLUXING. B. C. Finney and F. G. Kitts. Aug. 7, 1959. 15p. Contract W-7405-eng-26. $0.50(OTS).

The rate of chloride removal varied directly with HNO_3 concentration in an APPR-type Darex dissolver product containing 100 g/liter metal loading, 0.58 M initial chloride, and initial HNO_3 concentrations of 8, 9, 10, 12, and 14 M. The removal rate with 8 and 9 M HNO_3 was very low. After 6 hr refluxing, the chloride content decreased to 0.50 and 0.36 M, respectively. After refluxing for the same time with 10 to 14 M HNO_3, the product contained 0.064 to 0.0007 M (2270 to 25 ppm) chloride. The effect of air sparging was approximately equivalent to refluxing without sparging at a HNO_3 concentration 2 M higher. After 6 hr sparging and refluxing the chloride content varied from 0.034 to < 0.00014 M (1200 to < 5 ppm) for initial HNO_3 concentrations from 8 to 14 M. (auth)

18659 TID-8200

Division of Reactor Development, AEC.

NUCLEAR REACTORS BUILT, BUILDING OR PLANNED IN THE UNITED STATES, AS OF JUNE 30, 1959. 32p.

A compilation is presented of the facilities already built, presently being built, or planned in the United States as of June 30, 1959, which are capable of sustaining a nuclear chain reaction. Certain experiments relating to military systems are included but are not listed in detail because of their classified nature. (J.R.D.)

18660 WCAP-1192

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM, PHASE II. THE FEASIBILITY OF AN ANNULAR CORE REACTOR AS A REACTOR FUELS MEASURING DEVICE. Glen E. Putnam. May 31, 1959. 75p. Contract AT(30-1)-2176, Task 1. $12.30(ph), $4.50(mf) OTS.

The possibilities of determining changes in the U^{235} content of large fuel elements such as that of Yankee are investigated with respect to using an annular core reactor to perform reactivity measurements which compare a given fuel element to a standard element of known composition. The sources of error are analyzed and reported. (auth)

18661 WCAP-1221

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM, PHASE II. THE FEASIBILITY OF AN ANNULAR NUCLEAR CORE AS A REACTOR FUELS MEASURING FACILITY. John A. Vreeland. June 15, 1959. 25p. Contract AT(30-1)-2176, Task 1. $4.80(ph), $2.70(mf) OTS.

The sensitivity to changes in fuel content of a large, low-enrichment fuel assembly is studied for two measurements. These two measurements are, respectively, moderated with water and with a saturated solution of boric acid. It is shown that to conceal the removal of a fraction of the U^{235}, it is necessary to remove 5.5 times that fraction of the U^{238}. It is similarly shown that to conceal the addition of a fraction of U^{235}, it is necessary to replace one half of that fraction of the U^{238} with gold or some comparable material. (auth)

18662 WCAP-1232

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

NUCLEAR MATERIALS CONTROL SYSTEM, PHASE II. A DESIGN FOR THE EVALUATION OF A REACTOR FUELS MEASUREMENT FACILITY. Walter J. Rusnack. June 24, 1959. 31p. Contract AT(30-1)-2176, Task 1. $6.30(ph), $3.00(mf) OTS.

The purpose of the Reactor Fuels Measurement Facility (RFMF) is to make nondestructive measurements of fuel elements to indicate by comparison with the standard under wet or dry conditions a variation in fissile content in the absence of, or the presence of, nuclear poisons. The design of the Reactor Fuels Measurement Facility is presented. (W.L.H.)

18663

PREDETERMINATION OF THE BEHAVIOR IN TRANSIENT STATES OF THE 2000 kw REACTOR OF THE INSTITUTE OF NUCLEAR PHYSICS OF THE ACADEMY OF THE RUMANIAN DEMOCRATIC REPUBLIC. I. Purica. Acad. rep. populare Romîne, Inst. fiz. atomică şi Inst. fiz. Studii cercetări fiz. 10, 19-36 (1959). (In Rumanian)

The coefficients of the system of dynamic equations of the reactor were determined as a function of temperature by using transient states chosen in the region of small variations of reactivity and mean power. The coefficients of the reactivity temperature for the moderator and for the metal of the active volume could thus be separated as a function of temperature. To justify the precision of the coefficients obtained, the reactor transfer function calculated was compared with the experimental value. To predetermine non-linear transient states, a simple equation which describes the reactor behavior and is valid for the reactivity region $0 < \rho \leq \beta$ was used. The experiments made with the reactor in several transient states are described. (tr-auth)

18664

CERAMIC FUEL TESTING BY AUTORADIOGRAPHY. C. M. Jones, II and R. H. Benson (Norton Co., Worcester, Mass.). Am. Ceram. Soc. Bull. 38, 349-51(1959) July.

A simple and rapid technique is described for measuring the homogeneity of ceramic nuclear fuels containing urania, both normal and enriched, in a stable matrix such as fused alumina or stainless steel. Autoradiographs can be made and evaluated using emission spectrographic equipment and wet chemical analyses. A test procedure and results are given for enriched urania–alumina fuel strips. (auth)

18665

GEOMETRIC BUCKLING MEASUREMENTS USING THE

PULSED NEUTRON SOURCE METHOD. N. G. Sjöstrand, J. Mednis, and T. Nilsson (AB Atomenergi, Stockholm). Arkiv Fysik 15, 471-82(1959).

The geometric buckling of cylindrical reactors with one or both ends rounded has been determined by pulsed source measurements with small polyethylene geometries. The results were in general accord with theoretical calculations. The diffusion parameters of polyethylene were also determined. The diffusion length was 2.12 ± 0.03 cm, and for the capture cross section of hydrogen a value of 0.337 ± 0.005 barns was found. The effect of control rods was studied using thin cadmium rods in water. Good agreement was found for axial, central rods, whereas the theoretical predictions for the effect of diagonal rods were too high. (auth)

18666

DEVICES FOR RECORDING STABLE PERIODS OF NUCLEAR REACTORS. P. I. Popov and E. V. Filipchuk. Atomnaya Energ. 6, 666-8(1959) June. (In Russian)

Descriptions are given of two devices for measuring and recording stable periods of nuclear reactors. The devices are designed on the principle of logarithmic and potentiometric method of measuring. (R.V.J.)

18667

THE REACTOR HOUSING AND ITS TECHNICAL ARRANGEMENTS. R. Becker and H. Mahlitz (AEG Allgemeine Elektricitäts-Gesellschaft, Berlin); W. Dreibrodt (Siemens-Schuckertwerke AG, Berlin); and L. Schulz (Borsig AG, Berlin). Atomwirtschaft 4, 108-11(1959) Mar. (In German)

The reactor housing is a completely enclosed ferroconcrete body with a double skin outer wall. It has smooth plaster on the inside with an adherent coating of welded plastic foil. Special attention was given to the safety problems, especially to the ventilation arrangements which in normal operation prevent the escape of radioactive gases or aerosols but which in cases of accident must make possible the release of exact dosages. (tr-auth)

18668

THE WASTE WATER PURIFICATION PLANT. E. Ehn and H. W. Levi (Hahn-Meitner-Institut für Kernforschung, Berlin) and G. Knoerzer (Pintsch Bamag AG, Berlin). Atomwirtschaft 4, 117-19(1959) Mar. (In German)

The decontamination plant was laid out with great flexibility since it was required to be suitable for experimental purposes. After carrier precipitation and treatment with ion exchangers, the waste is diluted with town water. Special attention is given to safety arrangements. The waste water is carried in five separate conduction systems and checked by monitors. The removal of the ion exchanger and the sludge accumulating in the installation is done by remote control. (tr-auth)

18669

A NON-LINEAR STABILITY CRITERION FOR NUCLEAR REACTORS. Henri B. Smets. Bull. classe sci., Acad. roy. Belg. 45, 102-7(1959). (In French)

A nuclear reactor subjected to an instantaneous reactivity variation of any amplitude is asymptotically stable in the Liapounoff sense when the Fourier transformation of the pulse response of the reactivity feedback is non-negative. (tr-auth)

18670

THE PEG REACTOR. Énergie nucléaire 1, 109-14 (1959) May-June. (In French)

The PEG or Pegase experimental reactor which was shown at the Electrama Exposition, C.N.I.T., June 1959, is described. It is a swimming pool reactor of the heterogeneous type with 20% enriched fuel, moderated by light water. Its power is limited to a fraction of a watt to assure radiological protection. Nine independent gas-cooled loops for study of fuel elements are arranged about the core. Detailed descriptions are given of the container and purification loop, lattice, controls, control elements, and instrumentation. (T.R.H.)

18671

RESEARCH AND DEVELOPMENT PROGRAM OF THE CISE-ANSALDO GROUP ON HEAVY-WATER MODERATED, NATURAL URANIUM REACTORS. M. Silvestri (CISE, Milan). Energia nucleare (Milan) 6, 369-75 (1959) June. (In Italian)

For two years CISE has been studying natural uranium fueled, heavy water moderated, pressure tube reactors, cooled by light water-steam two-phase mixtures. A review is given of the research work by CISE in close cooperation with Ansaldo Company on nuclear, thermal, and mechanical problems related to this reactor concept. Advantages and disadvantages of the type being studied by the CISE-Ansaldo group in comparison with other more conventional types are discussed. (auth)

18672

WIGNER RELEASE IN GRAPHITE MODERATED REACTORS. II. THEORY AND EXPERIMENTS ON ANNEALING THE MODERATOR. C. Dalmasso (AGIP Nuclear, Milan) and G. F. Nardelli (Università, Milan). Energia nucleare (Milan) 6, 376-92(1959) June. (In Italian)

Wigner release in the moderator of an uranium–graphite reactor is studied with some typical boundary conditions and for some thermal perturbations. Next, Wigner energy release experiments which have been performed up to the present and related techniques are examined in some details. Some predictions on Wigner release in high-temperature reactors (T > 250°C), which are operating or being built, are presented. (auth)

18673

XENON OSCILLATIONS IN NUCLEAR REACTORS. G. B. Zorzoli (CISE, Milan). Energia nucleare (Milan) 6, 393-8(1959) June. (In Italian)

Conditions for xenon oscillations in nuclear reactors are reviewed, along with the analytical treatment. A first approximation analysis of xenon oscillations in three different reactor types is made by means of a simplified theory. Results of the analysis are then discussed. (auth)

18674

CRITERIA FOR THE DETERMINATION OF THE CONSTANTS OF THE TWO-GROUP METHOD. G. Casini and G. Rossi (Agip Nucleare, Milan). Energia nucleare (Milan) 6, 472-8(1959) July. (In Italian)

The two-group model of neutron diffusion is formulated to give a self-consistent form of the two-group constants, which will be directly suitable for calculation purposes. The mathematical formalism is sketched. The faults of this model, when applied to uranium–graphite reactors are considered. A proper correlation of experimental results is suggested to avoid the model faults. (auth)

18675

INVESTIGATIONS OF NON-UNIFORMLY HEAT TRANSFER IN NUCLEAR REACTOR HEAT RELEASING ELE-

MENTS. V. S. Ermakov and V. Ivanov. Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R. 1, No. 12, 96-112 (1958) Dec. (In Russian)

The problem of heat distribution in a multi-layer fuel element (FE) for a one-dimensional transient temperature field is considered when there is a nonuniform heat source (which is a function of the space coordinates and time) and convective heat exchange of the FE with a heat transfer medium at a variable temperature. Two methods for solving this problem are proposed. The first method is as follows. The differential equations for heat conductivity for a multi-layer FE are replaced by one differential equation having variable heat exchange characteristics (which approximate the jumps in the thermal and physical constants at the contact surfaces between the various layers in the FE). The solution to this differential equation with variable heat exchange characteristics is obtained by means of a finite integral transformation, whose kernel is found using operational calculus. The second method is based on operational calculus. In order to solve the problem, it is proposed to introduce a certain generalized Green's function into the Laplace transform domain. The first method gives the solution in the form of a series, the second in integral form, which is most convenient for calculation purposes when the Fourier criterion takes on small values (starting and shut down the nuclear reactor). The variety of the proposed solutions describes the transfer of heat in the FE under the most diversified operating conditions (starting the reactor, regulating its operation, normal duty, accidents). Therefore, the solutions obtained and the proposed methods of solving the heat conductivity problems are of practical interest in nuclear engineering. (tr-auth)

18676

TRANSISTORIZED REACTOR INSTRUMENTATION AND PROTECTIVE CIRCUITS. R. R. Hoge and D. J. Niehaus. IRE Trans. Nuclear Sci. NS-6, 42-8(1959) June.

Nuclear reactor instrumentation and protection circuits which cover a range of six and one-half decades of reactor power are described. The circuits have been designed to provide maximum protection for the reactor while maintaining the ability to prevent unscheduled shutdowns. To accomplish these features, solid state components and fail-safe designs have been employed wherever feasible. (auth)

18677

ZED-2, ANOTHER REACTOR FOR CHALK RIVER. Nuclear Energy Engr., 337(1959) July.

A design is given for a low-powered nuclear reactor specifically designed for testing the fuel arrangements in large reactors. ZED-2 will have a power or heat output of 100 w. It will be moderated with heavy water (about 25 tons) and in the early experiments will use bundles of uranium oxide rods as fuel. A normal fuel loading will weigh about 10 tons. The new reactor has apparatus for changing fuel rod arrangements by remote control. The core of ZED-2 is an aluminum tank 10 ft in diameter and 11 ft high containing heavy water. Fuel rods are suspended in the tank, and the power of the reactor is controlled by changing the height of the heavy water. (C.J.G.)

18678

REACTOR EARTHQUAKE TESTS. Nuclear Energy Engr., 349-51(1959) July.

A discussion is given, complete with plans, on the size, construction, and initial tests of a special seismic apparatus built for determining the stability of a graphite core under earthquake conditions. The tests confirmed that provided a proper supporting structure was used a suitably designed graphite reactor core could stand up to earthquakes without there being fear of collapse or deformation of the graphite which would prevent the entry of the reactor control rods. Safety of the reactor against earthquakes is assured. (C.J.G.)

18679

BURST SLUG DETECTION IN WATER-COOLED REACTORS. Denis Aliaga-Kelly. Nuclear Power 4, No. 39, 77-9(1959) July.

Several ways of detecting a break in the cladding of a fuel element are described. It is noted that the precipitation method offers the quickest response and highest sensitivity. Types of wire and rod precipitators now in use are discussed. (C.J.G.)

18680

NONSEPARABLE SPACE-TIME TRANSIENTS RESULTING FROM CHANGES IN INLET COOLANT TEMPERATURE. N. J. Curlee, Jr. (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 6, 1-10(1959) July.

An approximation scheme for calculating the detailed kinetic response of a reactor during a transient in which the time and space behaviors of the neutron flux are not separable has been applied to two reactor models more realistic than the one used previously to test the validity of the method. Results of applying the approximation method to a one-dimensional two-group reactor model and a two-dimensional two-group model are presented. (auth)

18681

APPROXIMATE ANALYSIS OF REACTOR START-UP INCIDENTS. H. Hurwitz, Jr. (General Electric Research Lab., Schenectady, N. Y.). Nuclear Sci. and Eng. 6, 11-17(1959) July.

A simplified method is presented for the approximate analysis of reactor start-up incidents. In particular, formulas are given for the inverse reactor period at the time when the power reaches the trip level. General results are derived for the total energy generation in the absence of a scram assuming that the reduction in reactivity is a linear function of the total energy which has been generated. (auth)

18682

REACTOR FUEL CYCLE ANALYSIS BY SERIES METHODS. Raymond L. Murray, S. A. Hasnain, and A. L. Mowery, Jr. (North Carolina State College, Raleigh). Nuclear Sci. and Eng. 6, 18-25(1959) July.

An analytical method is developed for determining the properties of a power or converter reactor as a function of time during the operating cycle. Account is taken of the space-dependent fuel consumption and production by the fundamental flux distribution. Average isotopic compositions, reactivity, isotopic power distribution, and cycle life are expressed in terms of "burnup" functions. These may be evaluated by the use of series involving tabulated flux averages over the core. (auth)

18683

A TIME-DEPENDENT ANALYSIS OF SPATIAL FLUX DISTRIBUTIONS. H. L. Garabedian and C. B. Leffert (General Motors Corp., Warren, Mich.). Nuclear Sci. and Eng. 6, 26-32(1959) July.

A technique is exhibited which permits an investigation of the changes in flux shape which occur when reactivity is inserted locally in an inhomogeneous re-

actor system and the power level rises. Thus, transient flux shapes at any time may be found as well as the asymptotic flux shape which is eventually attained. The reactor kinetics study in this article is motivated by a method of harmonics which does not employ the conventional assumption of separability of the flux into a product of a function of position alone and a function of time alone. From the point of view of practical applications the method is restricted to systems of rather simple geometry in which the slowing down is everywhere uniform and in which there are no nonlinear feedback effects. (auth)

18684

GAMMA AND NEUTRON HEATING IN AND ABOUT A HOMOGENEOUS REACTOR. Raymond Fox (Univ. of California, Livermore). Nuclear Sci. and Eng. 6, 33-6 (1959) July.

A hand calculational procedure used to estimate the gamma and neutron heating in and about a homogeneous reactor core is described. It affords a good insight into the physical processes involved, can handle complex geometries, and is relatively simple to do. One of the interesting results of the gamma heating part of this calculation is the heating of high-Z materials. In an example which is used for a medium-Z element, such as molybdenum, the gamma heating is four times more per unit mass than it is for a substance such as graphite. For higher-Z materials the heating is proportionately greater. One of the interesting results of the neutron heating part of the calculation is the heating of low atomic weight materials. The heating in water from the moderation of fast neutrons, for example, is found to be three times greater than that of the gamma heating. (auth)

18685

FABRICATION OF ZIRCALOY-2 CHANNELS FOR VALLECITOS BOILING WATER REACTOR FUEL ASSEMBLIES. C. N. Spalaris (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 6, 37-43(1959) July.

A process method and fixtures have been developed for fabricating square shaped Zircaloy-2 channels for the fuel assemblies used in the Vallecitos Boiling Water Reactor. Fourteen of these channels were made and assembled on fuel bundles. All of these bundles have been irradiated in the Vallecitos Boiling Water Reactor for various exposures and their suitability for this application has been established. Welds made using this process were as good as those produced in a controlled atmosphere box from the point of view of corrosion resistance and mechanical integrity. (auth)

18686

CONSTRUCTION WORK OF THE ISPRA-I REACTOR. G. Franco (Centro di Studi Nucleari di Ispra del C.N.R.N.). Nuovo cimento (10) 11, Suppl. No. 3, 361-5(1959). (In Italian)

The Ispra-I is a heterogeneous reactor using plate fuels of the MTR type, cooled and moderated by heavy water, with a graphite reflector. The fuel is 20% enriched uranium, and the thermal power of the reactor is 5 Mw. The design of the heavy water circuits is briefly described. The problems in the construction of the reactor are reviewed, and the present state of construction is reported. The reactor building is practically complete, and the reactor itself is in an advanced stage of construction. (J.S.R.)

18687

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 10. RESEARCH REACTORS. Geneva, United Nations, 1958. 555p. $18.50.

Papers from sessions B-5 and B-12 on research reactors are presented. Nine new high-flux research reactors (10^{14}), already in operation, are described and progress reports on others are given. This volume is composed largely of reports on each specific type of research or engineering test reactor. (W.D.M.)

18688

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 11. REACTOR SAFETY AND CONTROL. Geneva, United Nations, 1958. 556p. $15.50.

This volume consists of papers on reactor safety and control from sessions B-13, B-14a, and A-14. Legal and organizational matters, containment, safety devices, hazards associated with various types of reactor incidents, reactor kinetics, problems of boiling water reactors, control instrumentation, and control rod theory are considered. (W.D.M.)

18689

NUTZENERGIE AUS ATOMKERNEN. EINFUHRUNG IN PHYSIK UND TECHNIK VON KERNREAKTOR UND ATOMKRAFTWERK. (Useful Energy from Atomic Nuclei. Introduction to the Physics and Technology of Nuclear Reactors and Atomic Power Plants). Karl Rudolf Schmidt. Berlin, Walter de Gruyter & Co., 1959. 1300p.

A two-volume introduction to the physics and technology of nuclear reactors and power plants is presented. After a brief introduction, the fundamentals of nuclear physics are reviewed. The next chapter is devoted to the nuclear reactor with a consideration of elementary reactor theory. The properties and application of various construction and operating materials are discussed in the fourth chapter. In the chapter on the thermal power plant the transfer, removal, and use of the heat produced, the apparatus and machines and the thermodynamics of the complete process are studied. The chapter on chemical problems sketches the chemistry of the actinides and discusses the purification of the fissionable charge. In the second volume, the first chapter considers radiation effects and health physics. Fundamentals of shielding and reactor shielding are discussed in the chapter on radiation shielding. Control techniques include a discussion of reactor kinetics, reactor control, and power plant control. Pumps, armatures, measuring instruments for liquid metals, and reactor loading and special chemical problems caused by radioactivity are discussed. The criteria for selection of the type of nuclear power plant, the special plant technology in nuclear power plants, and plants for special purposes are briefly investigated. Questions on the supply of raw materials are also considered. The last chapter deals with economic and legal questions concerning nuclear power plants. (J.S.R.)

18690

PRODUCTION OF PLUTONIUM 239. Harrison S. Brown and Herbert L. Anderson. British Patent 815,641. July 1, 1959.

A graphite- and heavy-water-moderated reactor is described in which Pu^{239} and U^{233} can be produced. The liquid UF_6 fuel is circulated through a graphite moder-

ator. The circulation system has means for heat removal and bleeding or adding UF_6. The UF_6 removed is continuously processed for Pu and fission product separation. (T.R.H.)

18691

CARRIER FOR NUCLEAR FUEL ELEMENTS. (to Babcock and Wilcox, Ltd.). German Patent DAS 1 036 409. Aug. 14, 1958. Atompraxis 5, 247(1959) June. (In German)

A carrier for fuel elements removed from a reactor is described. The principal part of the carrier consists of a chute for the transportation of the fuel element from a higher to a lower level by the use of gravity. This chute is so arranged that a slowing down of the fuel element can be controlled at the discharge end of the chute.

18692

SPHERICAL FUEL ELEMENTS FOR NUCLEAR REACTORS. (to Deutsche Babcock and Wilcox-Dampfkessel-Werke Aktiengesellschaft). German Patent DAS 1 037 605. Aug. 28, 1958. Atompraxis 5, 247-8(1959) June. (In German)

It is suggested that the fuel elements be arranged in a sphere which consists of the moderator mass and that the sphere be covered with a metallic sheath. The fuel material should consist of enriched uranium, uranium oxide, or uranium carbide and the moderator of graphite. The advantage is that the heat expansion of the uranium would be absorbed easily by the elastic graphite mantle.

18693

SIMPLE LOADING OF A BORE-HOLE REACTOR BY ROTATION OF THE REACTOR CORE. (to Deutsche Babcock and Wilcox-Dampfkessel-Werke Aktiengesellschaft). German Patent DAS 1 038 666. Sept. 11, 1958. Atompraxis 5, 247(1959) June. (In German)

A method for the loading of a reactor is described which consists in the provision of only a few bore holes in the reactor cover and the rotation of the reactor cover or the reactor core around a central axis so that the bore holes in the reactor lie under the bore holes in the reactor cover. For this purpose the reactor core, which can be surrounded by a breeder mantle or reflector, is placed on a frame which can be moved about a central axis with a pivot bearing. It is possible to reach the complete core with a very small number of loading openings.

18694

SUPERHEATING OF STEAM BY THE HEAT ENERGY OF BREEDING MATERIAL. (to Babcock and Wilcox Co.). German Patent DAS 1 309 146. Sept. 18, 1958. Atompraxis 5, 247(1959) June. (In German)

A method and a reactor for the production and superheating of steam by nuclear energy are presented. In the method suggested, nuclear fuels were consumed in a thermal reaction zone with simultaneous emission of heat and free neutrons, and fertile material was used in fissionable materials with simultaneous heat development. A characteristic of the method is that the superheating of the steam results from the heat released in the transformation of the breeder element. The special advantage of the method is the production of superheated high-pressure steam which is necessary to the recovery of mechanical power with good efficiency. A reactor for the execution of the method is described.

18695

DISPERSION OF GRANULAR MODERATOR IN LIQUID METAL AS COOLANT FOR REACTORS. (to L. & C. Steinmüller G.m.b.H.). German Patent DAS 1 039 657. Sept. 25, 1958. Atompraxis 5, 246(1959) June. (In German)

A reactor with solid fuel elements, in which a liquid metal, such as sodium, is coolant and in which, in the region of the core, a solid moderator in granular form is dispersed in the coolant, is presented. A coolant which boils in the heat-producing region of the reactor can therefore be used. As a special advantage it was shown that in liquid-metal-cooled reactors the operating and safety characteristics would be similar to those of the boiling water reactor. The operating conditions were so selected that the coolant boils in at least one part of the reactor which has the same effect on the displacement of the coolant connected with a moderator dispersion as the occurrence of bubbles in the boiling water reactor.

18696

NEW KIND OF HOMOGENEOUS SOLUTION REACTOR WITH BREEDER OR CONVERSION MANTLE AND CIRCULATING FUEL. (to Vereinigte Kesselwerke Aktiengesellschaft). German Patent DAS 1 039 658. Sept. 25, 1958. Atompraxis 5, 247(1959) June. (In German)

A homogeneous reactor with circulating fuel and a conversion mantle is described. The breeder elements are contained in a pressure vessel. A diaphragm which is not liquid tight with respect to the fuel solution partitions the pressure vessel. Between the diaphragm and the wall of the pressure vessel the spherical breeder elements are arranged loosely. The fuel solution is pumped through the reactor. This solution forms in the spherical core a critical mass. Ports are provided for the removal and replacement of the breeder spheres.

18697

TUBULAR FUEL ELEMENTS PROVIDED WITH FINS PERMIT BETTER HEAT EMISSION AND IMPROVED NEUTRON ECONOMY. (to A.E.I. John Thompson Nuclear Energy Co., Ltd.). German Patent DAS 1 041 174. Oct. 16, 1958. Atompraxis 5, 248(1959) June. (In German)

A tubular fuel element for insertion in a coolant channel through which a coolant gas flows is presented. The fuel element is provided with fins or blades protruding at the rear which are made of the same fissionable material and are either formed in one piece with the tube or are solidly connected with it. It is noted that such an element, with respect to the temperature gradient, is as suitable as thin-walled tubes, so that in the passage of the heat through the uranium a proportionally small temperature difference exists between the surface and the interior of the element. Simultaneously there is a large exterior surface through which the heat can pass into the coolant gas. A relatively longer uranium path is offered the neutrons. Therefore, there is a greater probability for collisions between the free neutrons and uranium nuclei, which means that more neutrons are liberated.

Power

18698 ACNP-5904

Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee.

PATHFINDER ATOMIC POWER PLANT TECHNICAL PROGRESS REPORT [FOR] OCTOBER 1958–

DECEMBER 1958. Mar. 1, 1959. 87p. For Northern States Power Co. and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. $2.25(OTS).

Dynamic and static high-temperature water corrosion tests are reported for Al alloys such as X8001 + Mg and 198X. Data are presented for one dynamic comparison test for these two alloys at pH 5.5 with H_3PO_4. End closures of type 3003(Al−1.2% Mn) and X8001(Al−1% Ni) made by spinning were pressure leak tested and examined microscopically. Results are tabulated, and photomicrographs are included. All tubes that were spun but not welded had cracks, however, the fusion welded tubes were more sound. Progress in design activities related to reactor mechanical features is reported, including an analysis of boiler pressure drop and void distribution, and the recirculation system piping. Data on forces and moments due to thermal expansion in the loops under four conditions of support; and flow restraint at the pump are tabulated. Test information and conclusions on the design of control rods and guide tubes are given. An analysis of individual constituents of reactivity coefficients was conducted with the emphasis on nuclear parameters such as the thermal neutron spectrum, thermal disadvantage factors, resonance escape probability, fast fission factor, and epithermal neutron age. The reactivity changes produced by variations in these parameters are tabulated. Data are also given on the isoflux line patterns in the 64 rod core section obtained from calculations of flux and power distribution effects at the superheater boiler core interface. Control rod heating due to radiation was calculated as 1.22×10^6 BTU/ft^3-hr. Shielding design based on calculated activity buildup due mainly to crud is described, and one possible arrangement is considered in relation to the neutron and gamma flux. Reactor water purification design modification includes the addition of a booster pump under the flash tank to be used during reactor shut-down. Descriptions of control rod programming and circuits are presented, and a list of abnormal conditions to be considered in the design of a safety alarm system is given. Procedures for obtaining power and period measurements are given as well as the design of a steam pressure control device and a water level control and measurement system. Other instrument design work is reported on shut-down pump controls, leak and rupture detection, various emergency valves, flash tank controls, water pressure controller, resin protection controls, and various hand operated valves. Feasibility studies on fuel element design, fuel materials such as UO_2−stainless steel cermets, thermal expansion tests, air flow tests for superheater flow characteristics, and a cooling test are reported. Drawings and photographs related to materials and designs are included. (For preceding period see AECU-3910.) (J.R.D.)

18699 AECL-799

Atomic Energy of Canada Ltd., Chalk River, Ont.
ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 159p. $2.50 (AECL).

18700 AECL-799(Paper 1)

Atomic Energy of Canada Ltd., Chalk River, Ont.
REVIEW OF THE NUCLEAR POWER PROGRAMME. J. L. Gray. Paper 1 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 7p.

The nuclear power program is reviewed and compared with the programs of the US and UK. Cooperation with other countries is discussed. Information and costs of the program are given in terms of the four proposed reactors: NPD-2, CANDU, OCDRE, and Special Use Reactor. (W.D.M.)

18701 AECL-799(Paper 2)

Atomic Energy of Canada Ltd., Chalk River, Ont.
THE OPERATION OF ENGINEERING TEST REACTORS. G. F. W. Gilbert. Paper 2 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 9p.

Some of the physical characteristics of NRX and NRU are reviewed, and problems of operation are discussed. Present experimental setups at the NRX are given. A short rundown on the accidents or incidents that have been experienced with NRU and NRX is presented. (W.D.M.)

18702 AECL-799(Paper 3)

Atomic Energy of Canada Ltd., Chalk River, Ont.
PROGRESS IN NUCLEAR REACTOR DEVELOPMENT. G. C. Laurence. Paper 3 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 10p.

Background is given on the development of nuclear power in Canada. The energy content of the various forms of fuel and fuel reprocessing are discussed. The research reactors ZEEP, NRX, and NRU are described and illustrated. Research and development on NPD and CANDU are considered briefly, and future possibilities are pointed out. (W.D.M.)

18703 AECL-799(Paper 4)

Atomic Energy of Canada Ltd., Chalk River, Ont.
RADIATION SAFETY IN NUCLEAR SCIENCE. G. C. Butler. Paper 4 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 9p.

The role of a biology and health physics organization in the development and operation of a nuclear power program is indicated. Maximum permissible doses for workers are discussed. Dosages received by workers at AECL for normal operation and for the NRU Reactor accident are summarized. Decontamination of buildings and equipment is discussed. Tests showing radioactivity in urine for normal operation and for the NRU accident are summarized. (W.D.M.)

18704 AECL-799(Paper 5)

Atomic Energy of Canada Ltd., Chalk River, Ont.
REACTOR FUEL. W. M. Campbell. Paper 5 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 12p.

Fuel element design for NRX and NRU are reviewed. Fabrication of the UO_2 (Zircaloy-2 clad) elements and assemblies is discussed. Estimated fuel costs of the NPD are given based on the UO_2 cost, cost of Zircaloy-2 tubing, and burnup. The fuel costs are promising and they are on a firmer base than the costs for some other components of the reactor. (W.D.M.)

18705 AECL-799(Paper 6)

Atomic Energy of Canada Ltd. Nuclear Power Plant Div., Toronto.
PROGRESS IN THE POWER REACTOR PROGRAM. J. S. Foster. Paper 6 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 12p.

The design of NPD is about 85% complete, most equipment is on order, manufacture of the calandria has begun, and the order for the UO_2 pellets has been placed. The design work on CANDU up to the present

has consisted of computations to aid in the choice of reactor dimensions, steam pressure, and values for other main parameters. Costs for the CANDU Reactor are estimated. Related projects and cooperative arrangements with other countries are summarized. These include PRTR, CVR, Swedish Power Reactors, British Steam-cooled Reactor, OCDRE, and OMRE. (W.D.M.)

18706 AECL-799(Paper 7)
Atomic Energy of Canada Ltd., Chalk River, Ont.
SAFETY IN THE USE OF NUCLEAR REACTORS. G. C. Laurence. Paper 7 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 8p.

Consequences of reactor accidents and mechanisms for fission product release to the atmosphere are discussed. Automatic control of the reactor power as a means of preventing accidents is reviewed. The duties of various bodies in the safety program are summarized. (W.D.M.)

18707 AECL-799(Paper 8)
Atomic Energy of Canada Ltd., Chalk River, Ont.
SOME INTERESTING PROBLEMS ASSOCIATED WITH REACTOR OPERATIONS AT CHALK RIVER. D. D. Stewart. Paper 8 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 12p.

Performance data are given for NRX and NRU for the months December (1958) to April (1959) inclusive. Two developments which have arisen during recent operation of the NRX and NRU are described. One is the unexpected trouble with the fuel rod monitoring systems (pressure, temperature, and radioactivity). The other involves a heavy water leak from the vessel into the J-rod annulus. The fuel rod monitoring systems which measure the pressure, temperature, and activity of the coolant from each tube are described and operational difficulties are explained. (W.D.M.)

18708 AECL-799(Paper 9)
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE HANDLING OF WASTES FROM A NUCLEAR REACTOR. C. A. Mawson. Paper 9 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 10p.

Radioactive wastes produced by a nuclear reactor vary from intensely active sources such as the spent fuel elements to dilute solutions or gases which can be dispersed into surface waters or into the air without danger. Gaseous, liquid, and solid wastes from a reactor such as CANDU are discussed. Methods for disposing of high-level solid and liquid wastes at Chalk River are reviewed. An estimate of the cost of the waste-handling system for CANDU is presented. (W.D.M.)

18709 AECL-799(Paper 10)
Atomic Energy of Canada Ltd., Chalk River, Ont.
THE DEVELOPMENT OF FUEL FOR NRU. A. J. Mooradian. Paper 10 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 14p.

Considerations which led to the fuel development program for NRU are outlined. The method of fabricating the various types of fuel required by NRU is described. The performance of the fuel in the reactor and how this performance has changed some of the ideas on the requirements of a good operational fuel are discussed. (W.D.M.)

18710 AECL-799(Paper 11)
Atomic Energy of Canada Ltd., Chalk River, Ont.
DESIGN OF NPD AND CANDU. I. L. Wilson. Paper 11 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 16p.

Some of the features of nuclear power plants being designed and built in Canada following the concept advanced by AECL are outlined. The NPD with a rating of 20 Mwe is one of the first of a class of pressure-tube reactors with heavy-water cooling. CANDU (200 Mwe) is at a relatively early stage of its design and many of the essential features and parameters have not yet been set. It is planned to follow the design of NPD in so far as it is feasible. The NPD design is described in detail and known differences with CANDU are noted. (W.D.M.)

18711 AECL-799(Paper 12)
Atomic Energy of Canada Ltd., Chalk River, Ont.
ENGINEERING STUDIES IN THE DEVELOPMENT OF POWER REACTORS. J. C. Horsman. Paper 12 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 12p.

A proposed study of steam-cooled power reactors was chosen as an example of the nuclear engineering activities at Chalk River. The objectives of the steam-cooled study are enumerated, and the analytical and experimental programs are outlined. A great deal of the experimental work would be performed by analogs, test rigs, and the reactor test loops. Generally the test rigs are laboratory devices which set up simulated conditions of environment for the screening of materials, components, and design parameters. A brief description of some of the test facilities at Chalk River is given. (W.D.M.)

18712 AECL-799(Paper 13)
Atomic Energy of Canada Ltd., Chalk River, Ont.
FUEL AND STRUCTURAL MATERIALS FOR POWER REACTORS. E. C. W. Perryman. Paper 13 of ATOMIC POWER SYMPOSIUM HELD AT CHALK RIVER, ONTARIO, MAY 4 AND 5, 1959. 12p.

Reactors that can operate with natural uranium as fuel and heavy water as moderator and coolant (NPD, CANDU) are considered. The proposed fuel, UO_2 clad with Zircaloy-2, is discussed in terms of preparation, corrosion resistance, and irradiation behavior. The use of Zircaloy-2 as the structural material is justified. (W.D.M.)

18713 AECL-832
Combustion Engineering-Superheater Ltd., Montreal.
STEAM GENERATORS FOR PRESSURE WATER REACTORS. R. E. Vuia, J. A. Paget, and R. D. Winship. June 1959. 122p. For Atomic Energy of Canada Ltd. Nuclear Power Plant Div. (TDV-1). $3.00(AECL).

A survey of current technology on pressurized light water reactor steam generators is presented. In addition, a design evaluation based on factors related to heavy-water-cooled reactors is discussed. Factors considered in evaluating structural configurations include adequacy of steam separator volume, adaptability of the heat exchanger head design to low heavy water holdup volume, and other adaptability features. Materials for alternative construction specifications are considered. A discussion of feed water treatment technology is also included as well as bibliographies. (J.R.D.)

18714 AECL-833
Atomic Energy of Canada Ltd. Nuclear Power Plant Div., Toronto.
BIDIRECTIONAL FUELLING IN CANDU—VARIATION

IN LATTICE CONSTANTS THROUGH BURNUP. L. A. Smith and R. J. Atchison. June 10, 1959. 56p. (TDS-1). $1.50(AECL).

The error of ignoring the spatial variation of fuel composition in a reactor lattice that is fuelled bidirectionally was investigated. The usual simplifying assumption that the fuel composition is somehow maintained independent of position was avoided by working out numerically the fuel composition, and consequently the lattice properties as a function of position along the fuel channel. Certain simplifying assumptions were necessary nevertheless, and these are discussed. It appears, at any rate for the cases treated, that the usual simplifying assumption underestimates the reactivity and consequently the burnup attainable, and that there may be in some cases a small amount of flux peaking in the axial direction. (auth)

18715 AECU-4211
Sargent and Lundy, Chicago.
25 MWe DIRECT CYCLE BOILING WATER REACTOR PLANT COST STUDY FOR ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS. W. A. Chittenden and Henry M. Sroko. Mar. 19, 1959. 20p. (SL-1589). $4.80(ph), $2.70(mf) OTS.

A preliminary design of a 25 Mwe direct cycle boiling water reactor plant was prepared in which the reactor and turbine-generator equipment are located within a steel containment building. The control and service facilities are located in an adjacent building. The reactor furnishes 600 psig dry and saturated steam to a turbine-generator arranged for three stages of regenerative feed water heating with a plant thermal efficiency of 26.7%. Cost estimates were prepared for the plant described which indicate a unit cost of $410/kwe. (auth)

18716 AECU-4213
Duquesne Light Co., Shippingport, Penna.
DECAY HEAT REMOVAL SYSTEM. SECTION I. SECOND PERFORMANCE. Test Results DL-S-121 (T-550075). First issue, May 12, 1959. 3p. $1.80 (ph), $1.80(mf) OTS.

Operation of the decay heat removal system relief valve was checked, and it was found to operate satisfactorily. (auth)

18717 AECU-4214
Duquesne Light Co., Shippingport, Penna.
CORE I CONTROL ROD DRIVE MECHANISMS PERIODIC TESTS. SECTION I. EIGHTH PERFORMANCE. Test Results DL-S-148 (T-550011). First issue, May 19, 1959. 11p. $3.30(ph), $2.40(mf) OTS.

The operation condition of the rod drive mechanisms was determined so that operating personnel may be informed concerning malfunctioning mechanisms. No serious malfunctions of control rod drive mechanisms occurred. (auth)

18718 AECU-4215
Duquesne Light Co., Shippingport, Penna.
PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "B" SURVEY. SECTION II. SECOND PERFORMANCE. Test Results DL-S-184 (T-612076). First issue, May 19, 1959. 18p. $3.30(ph), $2.40(mf) OTS.

Radiation was generally low except for a few "hot spots." Monitored points decreased to very low levels during the fifteen hour test period. Discrepancies could be contributed to two causes: missing probe cans and use of more than one meter to monitor a point during the test. (C.J.G.)

18719 AECU-4216
Duquesne Light Co., Shippingport, Penna.
RADIATION LEVELS IN THE VICINITY OF THE PURIFICATION DEMINERALIZERS. SECTION I. SECOND PERFORMANCE. (2791 EFPH). Test Results DL-S-234 (T-641306). First issue, May 19, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The extent of activity build-up outside the 1AC and 1BD purification demineralizer vessels inside the concrete enclosures was measured. The radiation levels obtained at the different elevations inside the demineralizer enclosure indicate that the areas of maximum radiation in the demineralizers are increasing. During the first performance of this test, this area of maximum radiation covered a distance of approximately 1 ft for the 1AC demineralizer, while this performance resulted in a distance of approximately 1.5 ft. The distance over which peak radiation levels were obtained in the 1BD demineralizer increased from a single point high in the first performance to peak radiation covering of approximately 1 ft distance in the performance. (auth)

18720 AECU-4217
Duquesne Light Co., Shippingport, Penna.
RADIATION LEVELS IN THE VICINITY OF THE PURIFICATION DEMINERALIZERS. SECTION I. FIRST PERFORMANCE. (1767 EFPH). Test Results DL-S-234 (T-641306). First issue, May 19, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The radiation level outside the 1 AC and 1 BD purification demineralizer vessels inside the concrete enclosures remained constant, indicating that the decaying particles consist of nuclei with relatively long half lives. Tables are given showing power history four days prior to the test and radiation levels measured at specific elevations in the 1 AC and 1 BD purification demineralizer enclosures. Data recorded while monitoring the "hot spot" in the 1 AC and 1 BD demineralizer over a period of 9 hours after shutdown show that the radiation levels remained constant. (C.J.G.)

18721 AECU-4221
Duquesne Light Co., Shippingport, Penna.
REACTOR PLANT CONTAINER AIR COOLING SYSTEM PRESSURE SWITCHES. SECTION I. Test Results DL-S-273-S (RNI-20). First issue, May 19, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

It was determined that pressure switches could not be set to close the electrical contact at 2 psig on increasing pressure within the specified tolerance of ± 0.1 psig. It was possible to set the pressure at which the contacts open on decreasing pressure, at 1 psig, with the specified tolerance of ± 0.2 psig. (auth)

18722 AECU-4222
Duquesne Light Co., Shippingport, Penna.
PERIODIC REACTOR PLANT CONTAINER AIR LOCKS AND 48-INCH BUTTERFLY VALVES LEAKAGE AND PERFORMANCE TEST. SECTION II. FIRST PERFORMANCE. Test Results DL-S-206 (T-641103A). First issue, May 20, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

The purpose of this test was to prove the integrity of the 48-in. butterfly valves by means of an air pressure test, visual inspection and operating check. The leak rate for both sets of butterfly valves, which were

tested simultaneously, was different for each run. The pressure decreased at a rate of 5.3 psi/hr during the first run, while the pressure during the second run, after the valves had been opened and closed approximately 10 times, decreased at a lower rate or 3.7 psi/hr. Because of this, a definite leak rate could not be obtained. Apparently the valves are not reseating properly. (auth)

18723 AECU-4223
Duquesne Light Co., Shippingport, Penna.
FAILED ELEMENT DETECTION AND LOCATION SYSTEM (OPERATIONAL) TEST. SECTION I. Test Results DL-S-185 (T-641105). First issue, May 20, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The operational characteristics of the FEDAL System with respect to background activities and response of the electrical system to the mechanical system were determined. The electrical and mechanical response time plus the flow time through the monitor was equal to 120 seconds as determined for transport times of 50, 65, and 80 seconds. The background count indicated that the FEDAL instrumentation needs adjustment. (auth)

18724 AECU-4230
Duquesne Light Co., Shippingport, Penna.
REACTOR COOLANT PUMP NOISE MONITOR CABINET TEMPERATURE. Test Results DL-S-286-S (RNI-25). First issue, May 19, 1959. 3p. $1.80(ph), $1.80(mf) OTS.

The ambient temperature inside the reactor coolant pump noise monitor cabinets during normal operation was determined. The average temperature during the test period for the "AC" pump noise monitor cabinet was found to be 115.0°F while that in the "BD" cabinet was 117.4°F. During the same period, the average auxiliary control room ambient temperature was 81°F. The ambient temperature inside the noise monitor cabinets remained within the manufacturer's specified temperature limits of 32 to 122°F during the three day test period. (auth)

18725 BMI-APDA-636
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF CORE FUEL SYSTEMS FOR A FAST BREEDER POWER REACTOR. Sherwood L. Fawcett, ed. Nov. 5, 1957. 152p. For Atomic Power Development Associates, Inc.

The first phase of a program aimed toward the development of materials and a core-subassembly design for the second core of the Fermi Reactor is outlined. The ground rules established by APDA for the study were based upon the performance requirements of the reactor plant with some modification to permit higher power generation and upon a value of Pu produced of about $44 per g. Considerations of various factors led to the selection of the dispersion or cermet fuel as having the most potential for the Core II application. The fuel selected was a 30 vol. % dispersion of UO_2 in U−10 wt. % Mo or gamma-phase-type alloy, zirconium clad, in a flat-plate-subassembly design. The plant economics for subassembly designs of the fuel systems were evaluated at a core power level of 616 Mw. (W.D.M.)

18726 BMI-APDA-641
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF CORE FUEL SYSTEMS FOR A FAST BREEDER POWER REACTOR—ADDENDUM I. Charles K. Smith, David A. Dingee, and Joel W. Chastain. May 2, 1958. 20p. For Atomic Power Development Associates, Inc.

Report BMI-APDA-636 contains information on a study of core fuel systems for the Fermi Fast Breeder Reactor. In view of certain changes in philosophy and design, additional studies were performed which are based on a revised set of ground rules. The revised ground rules are: reactor power output shall be 830 Mwh with sodium outlet at 1000°F; plutonium revenue shall be calculated at the value of $30 per g; and blanket cycle time shall be based on 0.5 at. % burnup or 5 yr of residence time. Two new materials uranium carbide and uranium carbide dispersed in U−10 wt. % Mo alloy, were considered in addition to the materials previously considered. (W.D.M.)

18727 BMI-APDA-643
Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF CORE FUEL SYSTEMS FOR A FAST BREEDER POWER REACTOR—ADDENDUM II. Ronald F. Dickerson, ed. July 7, 1958. 76p. For Atomic Power Development Associates, Inc.

Because none of the systems evaluated in BMI-APDA-641 showed any economic promise within the revised ground rules, planning was initiated on a Fermi II reactor as opposed to the modified Fermi I dictated by the original ground rules. A brief summary of the major ground rule changes is presented. The basic method of evaluation and the criteria for choosing a design are the same as previously discussed in BMI-APDA-636. The five basic fuel systems chosen for economic evaluation in this phase of the program were: U−10 wt. % Mo alloy; UO_2 ceramic; UC ceramic; UC dispersed in U−20 wt. % Mo alloy; and UC dispersed in Inconel X. (W.D.M.)

18728 CF-58-1-138
Oak Ridge National Lab., Tenn.
HRT MOCKUP IODINE REMOVAL AND RECOMBINER TESTS. P. H. Harley. Jan. 13, 1958. 12p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Tests have been run in the HRT core system mockup which demonstrate that iodine can be successfully removed from dry steam by a silver bed. Such a bed is recommended to prevent iodine poisoning of the HRT recombiner catalyst. An added advantage will be removal of I^{135} from circulation, whereby reducing neutron losses to Xe^{135}, a daughter. Four experiments were made with the silvered Alundum pellets during which experimental mass transfer coefficients were determined. At 110°C the experimental kg was 25% of the theoretical value, and at 150°C the kg was 52% of the theoretical. The experimental efficiencies were 68% and 97.8% of the theoretical efficiencies at the above temperatures. Increasing the gas temperature greatly improved the correlation of the theoretical and experimental data. Two iodine removal tests were made using silver-plated stainless steel wire mesh. These two tests gave higher removal efficiencies than the corresponding tests with the silvered Alundum rings. The metal support is preferred also because of its greater mechanical and chemical stability. In particular, leaching of Na_2O from Alundum rings was noted in the HRT. In a test of the stability of the silver-plated wire mesh, only 0.0025% of the silver was lost in a 650 hour run. During mockup tests without a silver bed, iodine poisoning lowered the recombiner efficiency from 99.97% to 98% at the HRT design conditions. Increasing the recombiner temperature to 650°C was found to be effective in removing iodine poison from the platinum catalyst. (auth)

18729 CF-59-6-96
Oak Ridge National Lab., Tenn.
SUMMARY OF HRT RUN 14. J. R. Engel, P. N. Haubenreich, J. O. Kolb, and D. M. Richardson. June 8, 1959. 79p. Contract [W-7405-eng-26]. $12.30(ph), $4.50(mf) OTS.

A detailed study of HRT Run 14, which was abruptly terminated by the formation of a hole in the Zircaloy-2 core tank is presented. In this run the reactor was operated at high temperature and pressure for ten days from March 25 to April 4, 1958. Nuclear power operation extended from March 29 until April 4, when fuel solution leaked into the heavy-water blanket. The maximum power level attained was 6.4 Mw. The reactor equipment performance was satisfactory, except for the core vessel, but the nuclear operation was characterized by a power-dependent fuel solution instability, indicated by the critical temperature behavior, chemical studies, and power surges which appeared at higher power levels. (auth)

18730 CF-59-7-102
Oak Ridge National Lab., Tenn.
INVESTIGATION OF MECHANICAL METHODS OF SCALE REMOVAL FROM HRT HEAT EXCHANGERS. C. H. Gabbard, D. M. Eissenberg, J. C. Moyers, and I. K. Namba. July 21, 1959. 8p. Contract [W-7405-eng-26]. $1.80(ph), $1.80(mf) OTS.

Tests were conducted to determine methods of removing scale deposits from the HRT heat exchangers. A mockup of the heat exchanger header was cleared of a deposit of iron rust by reverse flushing at a flow rate below 75 gpm. A tube bundle consisting of 109 1/4 in. OD × 0.049 in. wall tubes was plugged with rust. Approximately 80% of these tubes were unplugged by using a 70 psi water pressure differential in combination with vibration from a pneumatic rivet gun. No mechanical method was employed in the tests which could clear the remaining tubes. (auth)

18731 CISE-68
Centro Informazioni Studi Esperienze, Milan.
PRELIMINARY DESIGN STUDIES ON FUEL ELEMENTS FOR A HEAVY WATER MODERATED, WET STEAM COOLED REACTOR. I. Casagrande, A. Cicchitti, and L. Cravarolo. May 15, 1959. 94p.

The design of natural uranium fuel elements for a wet steam cooled pressure tube power reactor is considered. Fuel element requirements are indicated, and specific approximations are discussed. Physical and mechanical properties of U, U–Zr alloys, and Zircaloy-2, whose values are involved in the fuel element design, are reviewed. The calculation method is presented in detail and examples are given. (W.D.M.)

18732 HW-59932
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE SIMULATION OF THE PLUTONIUM RECYCLE TEST; REACTOR ON AN ANALOG COMPUTER. W. D. Cameron. June 10, 1959. 93p. Contract W-31-109-Eng-52. $2.25(OTS).

The PRTR is described, and the purpose of an analog computer study is discussed. The Goodyear Electronic Differential Analyzer, Model A-14 was used and is described. The simulation scheme used is described. Results are given in the form of numerous graphs and charts. The use of the analog computer in simulating and studying the dynamic and kinetic characteristics of the Plutonium Recycle Test Reactor has proven to be valuable in analyzing the system. The accuracy of the results is estimated to be within 3 per cent. This allows 2 per cent for recorder errors and 1 per cent for computer errors. Computer errors can be attributed almost entirely to multiplier and function generator errors. The input and feedback impedances of the amplifiers are adjusted and temperature stabilized to be within 0.01 per cent. This approximation of error assumes the equation constants to be 100 per cent correct. (T.R.H.)

18733 MIT-OR-4
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
RECOIL ACTIVITY FROM STAINLESS-STEEL CLADDING: A MAJOR CONTRIBUTION TO COOLANT-STREAM RADIOACTIVITY IN GCR-2. W. L. Brassert, G. K. Gardiner, and F. H. Morse. Aug. 4, 1959. 47p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract 70. $1.50(OTS).

An estimate is presented of the radioactivity in the helium coolant of the high-temperature gas-cooled reactor, GCR-2, due to entry into the coolant of recoil nuclei from neutron-induced reactions which take place in the fuel element cladding, type 304 stainless steel. This estimate is based on the results of a thorough literature search undertaken to find the most suitable range-energy relationships for slow-moving heavy charged particles in stainless steel and the most accurate cross section data available. Two systems were considered: one without a filter and the other utilizing a by-pass filter designed to reduce the concentration of contaminants in the coolant. (auth)

18734 MND-E-1847-1
Martin Co. Nuclear Div., Baltimore.
ZERO POWER CHECK POINT EXPERIMENTS. VOLUME I. ERDL—TASK 100, PHASE 3. T. M. Olsen. Apr. 1959. 59p. Contract DA-44-009-ENG-3318.

The major results of the Task 100 Zero Power Check Point Experiment have been analyzed and the following conclusions were made. The discrepancy between the number of fuel elements required in a critical APPR-1 array and its Task 100 mockup (17 and 20 4/18, respectively) is due to less-than-specification boron loading in the APPR-1 and deviation of the mockup core structure and material content from the APPR-1 specifications. The specified loading for the APPR-1 was 2.649 gm of B-10.82 per fixed element. The elements used contained 88.6% of the specified. The reactivity worth of the heterogeneity difference between an APPR-1 fuel plate and its Task 100 mockup, the laminated fuel bundle, accounts for two of the additional fuel elements required to mockup the 17-element APPR-1 critical array. The analytical methods developed in Task 100, Phase 3, produced values of K_{eff} for the Task 100 just-critical cores which agreed with the experiment within approximately 0.5%. No adjustment factors were used. The analysis was performed with 18-group modified age theory, 3-group diffusion theory, consistent reflector savings and 3-group bucklings, and two-dimensional heterogeneity corrections. The SNK transport theory was used to compare the thermal flux distribution through the APPR-1 fuel plate and its Task 100 mockup fuel bundle. The K_{eff} results of an improved window shade model technique agree with the experiment with approximately 0.5%. Agreement of analytical and experimental gross flux distributions and values of material worth for a core with partially inserted control

rods should be improved by use of thin region theory and three-dimensional solutions of the diffusion equation. Material data for the Task 100 cores was obtained by chemical and spectrographic analysis and from the core design drawings. (auth)

18735 MND-FBR-1696
Martin Co. Nuclear Div., Baltimore.
FLUIDIZED BED REACTOR STUDY. PHASE I—FEASIBILITY. Feb. 1959. 254p. Contract AT(30-1)-2220. Task I. $3.50(OTS).

The Fluidized Bed Reactor (FBR) consists of a bed of fuel pellets which circulate in a confined core region as the result of the upward flow of fluid through the particles. In the present concept the fluid acts as a fluidizing, coolant and reactor moderator medium. This report is the results of the Phase I study to determine the feasibility of this concept. This evaluation of the liquid fluidization process to reactor core design covers the materials, fluid flow and heat transfer, nuclear criticality and control, and the system and stability characteristics of the FBR concept. It was concluded that with proper system design, using light water or organic fluidizing mediums, the concept is feasible and offers considerable promise for economic power production. The report concludes with the necessary development areas and investigations that must be undertaken to attain an operating reactor system. (auth)

18736 MSAR-59-78
MSA Research Corp., Callery, Penna.
SUBASSEMBLY COOLING AT DECAY HEAT POWER LEVELS. Technical Report 64. M. J. McGoff. July 17, 1959. 32p. Contract NObs-77023.

A stainless steel subassembly was inductively heated at constant power levels of 260 and 600 Btu/hr-cu in. to determine the mechanisms of cooling which prevailed when the subassembly was sprayed with water or submerged in water. The spray runs were conducted at subassembly temperatures of 200 and 600°F with water spray rates from 6–15 gpm. The water was observed to flood at 600°F, but not at 200°F. Subassembly cooling was more easily achieved in a vertical position than in a 15° list –5° trim position. In some cases, a 6 gpm water spray was inadequate to cool the subassembly whereas a 15 gpm spray always prevented excessive temperature excursions. Spray runs were conducted with steam rising through the subassembly channels at 15 ft/sec and a subassembly temperature of 600°F. Effective quenching of the subassembly depended on the back pressure placed on the entering steam. A percolating effect was observed when the subassembly was partially submerged in water at 200°F and inductively heated at constant power levels of 200 and 600 Btu/hr-cu in. The percolating effect cooled the subassembly until the submersion level reached 30%. At 20% submersion level, the temperature of the subassembly above the water level became excessive as less percolating of water occurred. (auth)

18737 NYO-2373
Sanderson and Porter, New York.
PEBBLE BED REACTOR PROGRAM. Progress Report [for] June 1, 1958–May 31, 1959. 332p. Contract AT(30-1)-2207. $5.00(OTS).

Section 3.0 prepared by Alco Products, Inc.

125 eMW Thorium Breeder. A two-region, batch-loaded, pebble bed reactor operating on the thorium–uranium fuel cycle and having a conversion ratio of 0.863 is described. From a study of the neutron balance of this system it was apparent that the conversion ratio could be improved, and in fact breeding might be attained, by designing as continuously loaded core where fresh fuel was added and spent fuel removed at a rate such that reactivity would just be maintained. A study was made of such a system from which a reactor was evolved having a breeding ratio of unity with a fuel residence time of 169.5 days at the 125 Mwe PBR operating conditions. Simultaneously, spherical uranium-graphite fuel elements were procured; tested mechanically, for fission product leakage and irradiated. From the results of this work it has been demonstrated that fuel elements having satisfactory structural characteristics can be built. They do not suffer any degradation of structural properties after irradiation to 1½% atom burnup of fissile material. They show promise of retention of fission products such that direct maintenance of the primary loop, under controlled conditions, is possible. Fuel Element Technology. The three basic types of uncoated PBR fuel elements (impregnated, admixtured, and lumped) were irradiated to a burnup equivalent to 18% of the fissile atoms in a reference PBR fuel element at a temperature of about 1300°F. Both the impregnated and the admixtured element gained in compressive strength, showed essentially no impairment of impact strength, and no damage to the surfaces. The lumped element showed a definite impairment of its physical properties. The leakage rate of several volatile fission product isotopes from a siliconized silicon carbide coated PBR fuel element was initially found to be of the order of 10^{-7} of the isotope production rate while under high level irradiation at 1350°F. However, this leakage rate increased several orders of magnitude after continued irradiation indicating a coating violation the nature of which remains to be determined. Reactor Physics. Three fuel cycles have been investigated. The continuously-fueled reactor concept provides a method of achieving a breeder reactor with a high fuel burnup and thus a reasonable fuel cost. If breeding were not required, the reactor could be designed for a longer core lifetime and a corresponding reduction in fuel cost. The batch-fueled reactor can be designed to breed on a Th-232 and U-233 fuel cycle at the expense of core lifetime. The reactor considered, which is near the optimum with respect to breeding ratio, had a core lifetime of only 39 days based on a uniform burnup calculation. When non-uniform burnup of the fuel is considered the lifetime will be reduced further. Batch-fueled reactors utilizing U-235 and U-238 can be designed to operate with enrichments varying from about 3 to 35% depending on the core diameter and lifetime required. Initial breeding ratios as high as 0.9 can be realized, although they should be subordinated to the core lifetime in order to minimize fuel cost. A further reduction in fuel cost could be made by using the continuously fueled concept, although the mechanical design problems involved should be given due consideration. Thermal and Hydraulic Analysis. The previous analysis of the batch-loaded reactor has been revised. Means of reducing fuel element temperatures are considered. Analysis of a continuously loaded reactor is included. System Activity and Clean-up. Extensive studies are described which were made in an effort to predict quantitatively the fission product leakage rate to the coolant system. Experimental Programs. Experiments using lead shot were performed to study the void distribution in packed-sphere beds. The shot was poured into a cylinder, and an epoxy resin was poured in filling the interconnected

pores. After solidification the cylinder was machined down to different diameters and measured. Studies of an unloading valve mechanism and of a loading mechanism are also described. Research and Development. Research and development planned for future programs in fuel element and additional systems prior to construction of an experimental reactor. Experimental Reactor. Preliminary studies are reported. Appendixes are included on Fuel Cycle Cost Calculations and Graphite Ball Infiltration Experiments. (T.R.H.)

18738 ORNL-2726
Oak Ridge National Lab., Tenn.
SPECIFICATIONS AND FABRICATION PROCEDURES FOR SM-1 CORE II CONTROL ROD FUEL ELEMENTS. C. F. Leitten, Jr., R. J. Beaver, W. J. Kucera, and J. E. Cunningham. July 29, 1959. 95p. Contract W-7405-eng-26. $2.50(OTS).

Stainless steel-base fuel elements of thin plate-type construction, containing a dispersion of enriched uranium dioxide, have been successfully employed in powering the Army Package Power Reactor. The control rod fuel element proposed for operation in the second core loading of SM-1, formerly designated as APPR-1, is described. The general characteristics of the component engineered for radioactive service in pressurized water at 450°F are described. An important feature of the new component is a built-in flux suppressor to minimize flux peaking at the void junction between the fuel and absorber sections of the control rod assembly. The underlying criteria which guided the design are presented. The technological factors, such as compatibility, corrosion resistance, and irradiation behavior, which led to the selection of UO_2 as the fissile compound, boron carbide as the burnable poison, europium oxide as the flux suppressor, and austenitic stainless steel as the cladding and matrix material, are reviewed. The fabrication procedures developed and adopted for manufacturing the component are presented in detail. Included are powder metallurgy processing of UO_2 and B_4C in stainless steel fuel compacts and Eu_2O_3 in stainless steel flux suppressor compacts, cladding of the fuel by roll bonding, and joining of the thin plates into an integral unit by brazing. Quality-control measures adopted to produce components, on a pilot plant basis, consistently within dimensional tolerances are described. The general requirements for manufacturing Core II control rod fuel elements are outlined for the purpose of informing prospective fabricators with the nature and scope of the undertaking. Detailed material specifications and dimensional requirements which the manufacturer is expected to meet are also provided. (auth)

18739 TID-8506
Office of Operations Analysis and Forecasting, AEC.
COSTS OF NUCLEAR POWER. July 1959. 32p. $0.50 (OTS).

An investigation of the cost of nuclear power is reported. Nuclear plants designed for the generation of electricity are of primary interest. Data are examined on the cost of electricity from plants presently in operation or planned. Long-term energy needs are not considered. Aspects considered are capital costs, annual fixed charges, fuel cycle costs, inventory charges, and cost of operation and maintenance. (J.R.D.)

18740 TID-8507
Division of Reactor Development, AEC.
REPORT OF THE FLUID FUEL REACTORS TASK FORCE TO THE DIVISION OF REACTOR DEVELOPMENT, UNITED STATES ATOMIC ENERGY COMMISSION. Feb. 1959. 192p. $1.75(OTS).

A relative comparison is presented of the fluid fuel reactor concepts (aqueous homogeneous, molten salt, and liquid metal fuel) to determine the: (a) present state of development and technical feasibility; (b) technical feasibility of breeding; (c) potential power cost in mills per kwh in a system optimized for power production; and (d) research and development program necessary to produce a reactor capable of achieving the cost potential for each concept. The molten salt reactor has the highest probability of achieving technical feasibility. This is largely due to the use of a solution fuel and the availability of a suitable container material (INOR-8). (W.D.M.)

18741 WAPD-MRP-80
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD APRIL 24, 1959 TO JUNE 23, 1959. 98p. Contract AT-11-1-GEN-14. $2.25(OTS).

The average rates of escape of soluble ionic fission products into the PWR primary coolant continued to increase. The alkaline permanganate–ammonium citrate decontamination process gave a very good decontamination factor when applied to contaminated 304 SS boiler tube specimens in a small laboratory flow loop. Thermal analysis of PWR-1 performance utilizing new nuclear design information for 5000 and 5500 EFPH was completed. The activity levels of the control rod shrouds, the tie rods, and the blanket exit water instrumentation assemblies were computed for up to 6 months after the end of Seed 1 life. The mechanical design effort on PWR-2 was largely devoted to the evaluation of the effects of the various core lengths on the design of individual core components. A study of the shroud design problems associated with control rod extensions and the methods of refueling cores of various lengths was completed. A new method of mounting thermocouple guide tubes in the upper shroud was devised. Studies indicated that holding the core in the vessel by clamping the support flange between the flanges of the reactor vessel and head is feasible. Failure of a PWR-1 type rod in the X-1-n test confirmed the hydriding susceptibility of zircaloy-2 in this configuration as well as the advisability of removing Ni from the alloy. Thermal conductivity tests of UO_2 rods in-pile indicated that the effective thermal conductivities increase by a factor of more than two when the diametrical gap is reduced from 3.5 to 1.5 mils. Modifications in pressure bonding techniques for oxide plate fabrication significantly improved quality. Results of exposure tests to 650°F water, pH 9-10.5, with LiOH, 2200 psi, showed that $BeO-UO_2$, $ZrO_2-CaO-UO_2$, and ZrO_2-UO_2 ceramic fuels are stable. A three-dimensional depletion study of PWR-1 was carried through Seed 1 life and is now complete through 3000 EFPH of Seed 2 life. Three-dimensional synthesis studies of Xe transient behavior observed at Shippingport predicted control rod worths in good agreement with measured values. Two analytical methods used to calculate the ratio of neutron activation in self-shielded boron lumps in adjacent fuel material were evaluated. Measurements on the PWR-2 mockup indicated that the use of control rod extensions increases the one-rod-stuck shutdown margin by ~0.4% $\Delta k/k$ for a 112 kg U^{235} loading. Epithermal and thermal neutron activation measurements were per-

formed in and near boron lumps in a five-cluster slab assembly to examine the self-shielding factors at various energies. (For preceding period see WAPD-MRP-79.) (W.D.M.)

18742 WAPD-PWR-PC-1696

[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
REACTOR PROTECTION AND MONITORING FOR PWR CORE 1—SEED 1 AFTER 3000 EFPH. A. I. Moss. [Jan. 1959]. 14p. $3.30(ph), $2.40(mf) OTS.

Reactor thermal performance evaluation of PWR Core 1 Seed 1 after 3000 EFPH has indicated that with the shift in power to the blanket, maximum heat flux conditions in the blanket approach maximum permissible values in the blanket material. Past performances of extended power testing have uncovered some areas of core monitoring that require further investigation. Recommendations for reactor protection and core monitoring for PWR Core 1 Seed 1 in light of the predicted thermal performance after 3000 EFPH and the two performances of the extended full power testing are presented. (auth)

18743 YAEC-115

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
EVALUATION OF ION EXCHANGE RESINS FOR USE IN THE YANKEE REACTOR. N. Michael and M. Bell. July 1959. 36p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $6.30(ph), $3.00(mf) OTS.

Radioactivity removal efficiencies, generally reported in terms of decontamination factors (DF), have been determined for aqueous corrosion and fission product solutions using mixed-bed ion exchange resins. Experiments show that many factors such as pH and constituent concentration affect the decontaminating ability of the resins. In carefully controlled laboratory tests, separate batches of radioisotopes often yield large differences in decontamination factors. The (H^+, OH^-) form of mixed cycle resins, which is capable of exchanging H—OH for acids, bases, and salts, gave DF values as low as 330 and as high as 1200. A typical alkali-releasing mixed cycle ion exchanger gave DF values between 7.7 and 95. Similarly, in a reactor application the decontaminating efficiency of the purification system may be expected to fluctuate with transient water conditions. Mixed-bed resin exhibits satisfactory thermal stability, as evidenced by the slight change in capacity on long exposure to moderately high temperatures. Eighteen weeks exposure to 140°F water, maximum temperature planned for ion exchange resin operation in the Yankee plant, caused only a 12% reduction in exchange capacity. Strongly basic anion resins were tested for their ability to remove boric acid from solution. With a 38 ppm boron concentration, the total capacity of the recommended anion resin for use in the Yankee reactor, Rohm and Haas XE-78, was found to be 4.6 lbs/cu ft. With more concentrated solution, the capacity of the resin increased; under alkaline conditions the capacity decreased. Stainless steel corrosion products, generated in a dynamic autoclave at 600°F, were circulated through a low-pressure purification system consisting of a demineralizer and/or filters. Several properties were determined: quantity of crud picked up until resin is exhausted; quantity of crud picked up by cellulose filters up- and down-stream of the resin bed; efficiency of resin regeneration; and affect of resin on corrosion products, rendering these more filterable. The experiments also showed that the elemental composition of stainless steel corrosion products is dependent upon conditions such as the oxygen content of the water. It was observed that the mechanism of crud pick-up by resin consists of a combination of ion exchange and filtration. Consequently, any calculations of resin service-life for a reactor purification system based solely on resin exchange capacity give an inaccurate and pessimistic estimate. (auth)

18744 YAEC-134

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD JUNE 1 TO 30, 1959. H. E. Walchli. July 20, 1959. 12p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph), $2.40 (mf) OTS.

Work on fuel element preparation, nuclear design and reactor physics, chemistry, mechanical design, thermal and hydraulic design, control rod development, and radiation damage experiments is briefly reported for the Yankee Power Reactor. (For preceding period see YAEC-129.) (W.L.H.)

18745 AD-153387

NUCLEAR TRANSPORT. R. G. Perel'man. Translated from Politekh. Obuchenie, No. 6, 66-79(1957). 40p. OTS.

A review of progress in Soviet studies of nuclear transport is presented. Reactors are classified in general terms, and a non-technical operation description is given. Plans for a nuclear fleet are outlined as well as those for atomic locomotives and automobiles. Also, future aviation applications of atomic energy are discussed. The U.S. submarine Nautilus and a 1955 U.S. effort in nuclear aviation are mentioned. (J.R.D.)

18746 AEC-tr-3739

ATOMIC ENERGY AND NAVAL PROPULSION IN 1958 AND ITS DEVELOPMENT PERSPECTIVES. (L'energie atomique et la Propulsion Navale en 1958 et ses Perspectives de Developpement.) J. P. Ricard. Translated from Age nucléaire No. 11, 187-93(1958). 22p. $0.75(OTS).

A survey of 1958 nuclear marine propulsion progress is presented. The U. S. submarine program is reviewed as well as U. S. surface unit development. It is pointed out that in ten years the U. S. Navy will have about 50 atomic units in service. The progress in other countries such as Russia, England, and France is also discussed. Merchant marine applications such as the N. S. Savannah and the Lenin are examined, and a discussion of economic factors is presented. (J.R.D.)

18747 AEC-tr-3747

NUCLEAR NAVAL PROPULSION: TANKERS, LINERS. (CONDITIONS OF PROFITABILITY). R. Gibrat. Translation of a paper presented at the Nuclear Energy Days Conference, held at Milan, December 12-14, 1958. 37p. $1.25(OTS).

A review of progress and plans for nuclear naval units built or under construction is presented. The merchant marine type vessels are of primary interest, however, the influence of warships is noted. Progress in several nations is reviewed and plans for such countries as U. S., Japan, Germany, Denmark, and others are given. In addition, profitability is discussed, and comparative data are presented concerning various combinations of reactors and ships. It is concluded that nuclear propulsion is more important to military than to other

marine applications; and that the PWR is the most appropriate reactor. (J.R.D.)

18748 NP-tr-261

SUCCESS OF SOVIET UNION IN UTILIZATION OF ATOMIC ENERGY. Translated from Sovet. Aviatsiya, No. 213, Sept. 10, 1958. 5p. $1.80(ph), $1.80(mf) JCL or LC.

A brief summary is presented of achievements in the development of nuclear power and controlled nuclear fusion which were reported during the Second International Conference in Geneva. (C.H.)

18749

INVESTIGATIONS OF THE CONTAMINANTS IN THE FIRST NUCLEAR POWER PLANT WATER COOLING CIRCUIT. P. N. Slyusarev, V. A. Ivanov, and L. N. Nesterova. Atomnaya Energ. 6, 639-43(1959) June. (In Russian)

The rate of primary water contamination by 1X18H9T steel corrosion was investigated. It was found that the corrosion rate is proportional to the purge rate and to reactor power. Using radiochemical, analytical, electrodialysis, and ultra-filtration methods, it was shown that Co, Cr, Mn, Na, and Ni were present as ions while Cu and Fe appeared in a colloidal state. The use of deaerated water and a change in surge tank design were recommended. (R.V.J.)

18750

NUCLEAR FUEL ELEMENTS AND THE COST PER KILOWATT HOUR. Heimo Hardung-Hardung (Deutsche Gold-und Silber-Scheideanstalt vorm. Roessler, Degussa, Frankfurt am Main). Atomwirtschaft 4, 259-60 (1959) June. (In German)

Reductions in the price of fuel elements affect the cost of power generation in nuclear power plants little since the differences are small with respect to the total costs. Lack of quality in fuel elements can, however, result in considerable increase in costs because of operational interruptions and the possibility of reactor damage. The most important problems in the fabrication of fuel elements are, therefore, quality control and statistical data on operating life. (tr-auth)

18751

THE USE OF UO_2 AS CERAMIC FUEL ELEMENT IN NUCLEAR REACTORS. M. E. A. Hermans and J. P. W. Houtman. Atoomenergie 1, 93-101(1959) June. (In Dutch)

The relative advantages of the use of ceramic fuel materials in power reactors are discussed. Attention is given to some aspects of the uranium-oxygen system and to modes of UO_2 fuel preparation. The results obtained during development of preparation methods for special fuel particles to be used in the KEMA suspension reactor shows the importance of fundamental research in precipitation techniques. It is also argued that fundamental knowledge about properties of base materials and their function in compacting and sintering could stimulate the development of better and cheaper UO_2 fuel elements. 31 references. (auth)

18752

THE DRAGON PROJECT. A. W. Haslett. Atoomenergie 1, 103-5(1959) June. (In Dutch)

A brief survey is given of the design of the Dragon Reactor. The reactor temperature, canning of the fuel elements, gas coolant, and possible use of plutonium as fuel are considered. (J.S.R.)

18753

THE FIRST NUCLEAR ELECTRIC POWER STATION IN BELGIUM. THE MOL BR-3 REACTOR. II. J. Wertz (Centre d'Étude de l'Énergie Nucléaire, Brussels). Bull. inform. assoc. belge develop. pacifique énergie atomique No. 20, 17-22(1959) May. (In French)

The nuclear characteristics of the BR-3 Reactor are discussed with respect to the core and safety consideration. The conventional equipment described are the turbine and its circuit and the alternators. Problems in the operation of the power plant are the loading and unloading of the fuel, reactor startup, and reactor shutdown and cooling. Each are briefly described. (J.S.R.)

18754

NUCLEAR POWER PLANTS AND ECONOMIC ASPECTS. Frigyes Lomb. Energia és Atomtech. 11, 558-9(1958) Sept.-Oct. (In Hungarian)

The cost of electric power generated in atomic stations in Great Britain, France, and USA showed disappointingly high cost/Mwh values, indicating that nuclear energy cannot be counted on to cover the energy need of Hungary in the near future. (R.V.J.)

18755

PROBLEMS OF HEAT EXTRACTION IN THE COOLING OF NUCLEAR REACTORS. Judit V. Nagy (Power Plant Design Office). Energia és Atomtech. 11, 639-41(1958) Sept.-Oct. (In Hungarian)

The heat transfer problem in reactors is considered mathematically for homogeneous cylindrical systems. It is concluded that the temperature and thus the flux distribution should be uniform in order to improve the utilization of the coolant and to reduce the required amount of nuclear fuel. Formulas were derived for optimizing the heat transfer efficiency. (R.V.J.)

18756

GRAPHITE–URANIUM REACTOR WITH SUPERHEATED HIGH-PRESSURE STEAM. N. A. Dolležal, A. K. Krasin, and P. I. Aleščenkov. Jaderná energie 5, 74-83(1959). (In Czech.)

Full particulars are given about experimental work, physical characteristics, design, general arrangement, and operation of a 400-Mw atomic power station. The layout of this station now under construction in USSR is based on experience gathered in operation of the first atomic power station. As expected, the costs of power production should not exceed those of normal caloric power plants. (auth)

18757

THE WINDSCALE ATOMIC PILES. Tom Bishop (John Miles and Partners, Ltd., London). Metal Progr. 76, No. 1, 105-9(1959) July.

Both plutonium-producing piles at Windscale (using atmospheric air as a coolant) were shut down because the graphite moderator was dangerously overheated by "Wigner energy." The effects of irradiation on various components are discussed. A plan for releasing the "Wigner energy" is given. (C.J.G.)

18758

LUBRICANTS IN NUCLEAR POWER STATIONS. H. C. O'Connor (Shell-Mex and B. P. Ltd.). Nuclear Energy Engr., 352-3(1959) July.

The problems of development and production of many different lubricants for nuclear power stations are discussed. Qualifications and the various properties of the lubricants are brought out in the discussion. (C.J.G.)

18759

FUEL CYCLE OPTIMIZATION IN POWER STATION DESIGN. P. J. Grant (General Electric Co., Ltd.,

Erith, Kent, Eng.). Nuclear Power 4, No. 39, 73-6(1959) July.

Frequent on-load rearranging of fuel is discussed as an important factor in reducing power costs from second-round gas-cooled stations. (C.J.G.)

18760

PROGRESS IN NUCLEAR ENERGY. SERIES VIII. THE ECONOMICS OF NUCLEAR POWER INCLUDING ADMINISTRATION AND LAW. VOLUME 2. Edited Proceedings of the Second International Conference on the Peaceful Uses of Atomic Energy, Geneva, 1958. I. R. Maxwell, P. W. Mummery, and Philip Sporn, eds. New York, Pergamon Press, 1959. 435p. $15.00.

Selected papers on the economics of nuclear power are included which were presented to the Second International Conference on the Peaceful Uses of Atomic Energy, 1958. Topics covered include the world demand for nuclear energy, nuclear fuel supply and costs, the generation of nuclear energy, and a review of world-wide nuclear power programs. (C.H.)

18761

IMPROVEMENTS IN OR RELATING TO HETEROGENOUS NUCLEAR REACTORS. Everett Long and Kenneth William Cunningham (to Plessey Co., Ltd. and United Kingdom Atomic Energy Authority). British Patent 814,416. June 3, 1959.

Fuel element leak detection apparatus is described which permits continuous monitoring at one sampling point without interfering with monitoring at other points. The invention consists of a set of sampling pipes connected to the input of a valve. The valve output can be switched between a group of manifolds or one single manifold. (T.R.H.)

STABLE ISOTOPE SEPARATION

18762 IGRL-T/CA-102

FURTHER DEVELOPMENT OF HERTZ'S COUNTER-CURRENT DIFFUSION APPARATUS. H. Barwich and R. Kutscherow. Translated by B. Rigby (U.K.A.E.A., Risley) from Proc. Intern. Symposium Isotope Separation, Amsterdam, 1957. (1958). 8p.

Various types of isotope separation pumps which were originally developed by Hertz were tried. Two of them had metal tubes with slits and another type had a porous wall tube, but both remained essentially diffusion pumps, which made it possible to construct cascades. The choice of the size of the pores, of the pressure, and of the temperature for various gages were discussed. The whole resembles gas diffusion theory of a stage with a porous barrier. Counter-current diffusion with amplification of the elementary separation effect according to the Clusius/Dickel principle was studied. The convection current was established by the pumping action of these separation pumps. Using the porous wall tube, convection arises as the gas diffuses against the vapor flow into the inner part of the tube and at the lower side, whereas at the upper side the opposite movement takes place. The essential difference from thermal diffusion tubes is that the convection currents are varying along the tube, which seems to increase the separational power. With a tube length of 50 cm and with four convection vortices over each other a separation factor 2 was obtained with Ne^{20} and Ne^{22}. (auth)

18763

HOW LINDE MAKES HEAVY WATER FROM HYDROGEN. Chem. Eng. 66, No. 4, 68, 70, 72(1959) Feb. 23.

A heavy water plant to be operated in conjunction with an ammonium nitrate fertilizer plant is described. Initial electrolytic deuterium enrichment of hydrogen takes place in a three-stage water electrolysis plant. A part of the hydrogen produced for the ammonia synthesis plant is run through the hydrogen distillation plant, the deuterium drained off, and the hydrogen returned. Natural water is used to scrub deuterium from electrolytic hydrogen before feeding to the cells. Contaminants such as water, carbon dioxide, and nitrogen are frozen out, and the purified enriched hydrogen is fractionated following an interim step which catalyzes concentrated HD to an equilibrium mixture of D_2, HD, and H_2. Pure oxygen burns the final fractionation product to water containing 99.8% deuterium oxide. (J.R.D.)

18764

A MASS SEPARATION WITH MAGNETIC FOCUSSING OF THE 2nd ORDER. B. Arcipiani, G. Barsanti, M. Fumelli, L. Musumeci, and N. Talini (C.A.M.E.N., Livorno, Italy). Nuovo cimento (10) 12, 611-15(1959) June 16.

An electromagnetic isotope separator with a 90° analyzing magnet, radius 40 cm, and second-order magnetic focusing is described. The first experimental results obtained with a low-power ion source are presented. The device is designed for the production of very pure isotopic samples for research purposes. (auth)

18765

PROCESS FOR THE ENRICHMENT OF WATER IN DEUTERIUM OXIDE. U. K. Atomic Energy Authority British Patent 800,730. Nuclear Eng. 4, 188(1959) Apr.

Details are given of the exchange reaction between water and deuterium-containing hydrogen in the presence of a catalyst of the type: nickel on a chromium sesquioxide base, platinum on alumina, or on silica, or carbon, and palladium on carbon.

18766

DUAL TEMPERATURE ISOTOPE EXCHANGE PROCESS. U. K. Atomic Energy Authority (U.S.A.). British Patent 800,851. Nuclear Eng. 4, 188(1959) Apr.

A process for the concentration of deuterium in cyclohexane and hydrogen is described. Two interconnected exchange units are provided, one operating at 100°C and the other at 250°C. The hydrogen and cyclohexane gases are passed successively through the two units and intimate mixing is obtained by countercurrent action. The low-temperature unit promotes the transfer of deuterium from the hydrogen to the cyclohexane and the high-temperature unit promotes deuterium transfer in the reversed direction. The operational pressure in the units may be 100 atm.

18767

PROCESS FOR THE RECOVERY OF HEAVY HYDROGEN AND HEAVY WATER. (to Stamicarbon N. V.). British Patent 816,098. June 17, 1959.

An improvement is offered for the D_2O recovery process based on catalytic exchange of D_2 between H_2 and water vapor. The suggested improvement results in heat economy. (T.R.H.)

TECHNOLOGY

Feed Materials

18768 MCW-1430

Mallinckrodt Chemical Works, St. Louis.

PROCESS DEVELOPMENT QUARTERLY REPORT.

PART I — LABORATORY WORK. J. U. Shepardson and J. A. Nelson, eds. July 1, 1959. 113p. $2.50(OTS).

A repetition of a 10-day sampling program of refinery streams has again shown that aqueous entrainment in the TBP-hexane extract is responsible for the major fraction of the impurities in refinery NOK liquors. In particular it was demonstrated that sodium, magnesium, vanadium, iron, and molybdenum contamination of the final product could be effectively reduced by reducing this aqueous entrainment. Distribution data for extraction of uranium into 30% TBP-hexane in the presence of sulfate has been gathered over a wide range of concentrations. The rate of reduction of fluid bed-denitrated UO_3 was found to increase with an increase in surface area and with increase in reduction temperature in the range 528 to 647°C. The nature of the hydrofluorination reaction depends upon the type of particles used as starting material. In very thin beds one type of fluid-bed-denitration product has an increasing hydrofluorination rate with temperature in the range 380–620°C, while in thicker beds thermal damage is observed. A second type of UO_3, consisting of sponge-like aggregates of smaller particles, showed thermal damage in thin beds (445°C rate > 640°C rate). Two distinct types of UO_3 have been produced in the fluid-bed-denitrator. Both types are characterized by low surface area, and both reduce to a brown oxide of relatively high surface area. The product of pilot plant runs prior to run 61 can be characterized as being made up of a shell surrounding a concentric, layer-type structure. The product of later runs have an interior made up of spongy matter without the concentric rings. Although both types of material are thermally damaged at high temperature, the latter material was the more susceptible. The rate of hydrofluorination of flame-processed UO_2 is apparently controlled by two consecutive mechanisms a) adsorption of HF on the available surface of the UO_2 aggregates with an apparent activation energy of 10 kcal/mol; and b) diffusion of HF and H_2O through the UF_4 film with an activation energy of 10 kcal/mole. The observed rate for the final 50% of hydrofluorination is proportional to the first power of the HF mole fraction in HF-Argon mixtures. Activated charcoal appeared to be the best method of adding carbon to small bombs. Neither hydrogen nor metal yield was adversely affected in the production of metal containing 400-500 ppm carbon. A careful quantitative study of the hydrogen balance in the 4-kg bombs indicates that a) the hydrogen in U metal is primarily determined by the total quantity of hydrogen in all forms in the bomb at firing and b) at constant hydrogen content, the degree of contamination is proportional to the maximum pressure occurring during the reaction. Good agreement between the hydrogen content of metal made in 4-kg bombs and that from 3300-lb dingots was obtained when the small scale bombs were fired with center temperatures approximating those of the large dingot. Bomb charges held at temperatures of 300°C or higher show a decrease in the hydrogen in as-reduced metal with increased time at temperatures before firing. Soaking at 250°C was ineffective in reducing hydrogen. The magnitude of this effect seems to depend on the water soluble content of the greensalt. Four-kg bombs containing added water (equivalent to 280 to 1120 ppm hydrogen) produced metal with hydrogen content proportional to the added water, providing all bombs were fired at a similar center temperature. Examination of plane sections taken at various distances from the quenched end of Jominy-type specimens by inverse pole figure and "growth indices" reveal similar structures in uranium, which prior to beta quenching had been: a) gamma-extruded, alpha-rolled dingot; b) alpha-forged, alpha-rolled dingot; c) or alpha-rolled ingot. The rate controlling role of nitrous acid concentration in the dissolution of uranium metal was confirmed. Tests related to the development of a simplified uranium ore-concentrate assay procedure are described. Uranium losses during the phosphate precipitation step were eliminated by adjustment of precipitation and digestion conditions. Sodium ethylenediaminetetraacetate was used successfully to complex the impurities Fe(III), Cu(II), W(VI), Co(II), V(V), Mo(VI), and As(V). (auth)

18769 MCW-1431

Mallinckrodt Chemical Works, St. Louis.

PROCESS DEVELOPMENT QUARTERLY REPORT. PART II. PILOT PLANT WORK. J. U. Shepardson and J. A. Nelson, eds. Aug. 1, 1959. 73p. $2.25 (OTS).

Efficiency of the pilot plant pumper-decanters was greatly improved by the maintenance of interfaces. The low efficiency of the D-3 pumper-decanter in the plant could be substantially raised by an interface to prevent backmixing. A review of refinery performance, based on a correlation of wash raffinate density with extract uranium saturation, showed that high-thorium product resulted from low extract saturation. Tributyl phosphate recovery by hexane stripping of raffinate can be greatly improved through the use of a pumper-decanter in place of the present open column. The pilot plant fluid-bed denitrator has been operated at production rates as high as 500 lb UO_3/hr-sq ft using high feed concentrations. Correlations of previous particle size and heat transfer data are presented. A pilot plant fluid-bed reduction reactor with a tapered internal mandrel has been placed in service. The equipment has performed well in preliminary runs. Equipment to convert low concentration HF to 38% HF by distillation has been installed. Runs have been made in the green salt reactors in order to simulate the conditions whereby the 38% HF will be utilized. These runs demonstrate the ability to produce high-quality UF_4 utilizing 38% HF to the "A" reactor tube. Laboratory analysis of green salt produced at Port Hope, Canada, indicated the green salt to be approximately comparable to Weldon Spring material, with the exception of hydrogen content, which was about twice the level found in Weldon Spring green salt. Metal from 3300-lb dingots, produced from this green salt by the long-soak technique, had hydrogen levels of 3.9 ppm and 3.4 ppm, which are higher than is normally found in metal produced by the long-soak technique. (auth)

18770 MCW-1432

Mallinckrodt Chemical Works, St. Louis.

A PROCESS FOR CONTROLLING INSOLUBLE URANIUM IN ORE CONCENTRATES. III. PLANT OPERATION. W. S. Knecht and L. R. Hollrah. July 31, 1959. 27p. $1.00(OTS).

A Herreshoff furnace was successfully utilized to achieve a reduction in the nitric-acid-insoluble-uranium content of Vitro concentrate to a level of about 0.15% on a sample basis. The temperature of the powder was maintained at 1200°F to 1240°F because overheating the concentrate produced lumps that were not completely reduced and, in some cases, caused plugging of the hearths. Lower temperatures did not give the desired reduction in insoluble uranium content. The incremental

cost for processing concentrate at a rate of 500 pounds per hour was calculated to be $0.015 per pound of concentrate. The total savings resulting from reducing the insoluble uranium content is estimated to be $128,000. (auth)

18771 NLCO-718
National Lead Co. of Ohio, Cincinnati.
PRODUCTION OF POROUS PELLETS OF HYDRATED ORANGE OXIDE. Paul W. Henline, Earl W. Mautz, and Edward J. Walter. July 1, 1957. 53p. Contract AT(30-1)-1156. $1.75(OTS).

An efficient and economical process has been developed for the continuous production of porous pellets of hydrated UO_3. The pellet production operation consisted of feeding and mixing of UO_3 powder with dilute aqueous ammonia followed by extruding and curing of the resulting paste. The feasibility of continuous mixing of an ammonia–water–UO_3 mixture in a muller mixer followed by a pug mill was established. Indications of adequate drying and curing by heating on a moving belt supplemented by subsequent storage in bulk quantities were developed. Pellets were produced by this process in tonnage quantities as feed for a pilot plant moving bed reactor. (auth)

18772 NLCO-781
National Lead Co. of Ohio, Cincinnati.
INVESTIGATION OF HYDROMETALLURGICAL SYSTEM ACID LEACHING MEDIA. Alvin B. Kreuzmann. Oct. 27, 1958. 27p. Contract AT(30-1)-1156. $1.00 (OTS).

Modifications to the acid leaching media employed in the recovery of uranium from halide-contaminated scrap residues have been developed from laboratory data and have been demonstrated in the National Lead Company of Ohio Metals Recovery Plant. The conservation of acid and hydroxide values is effected by acid recycle and high-pulp-density leaching techniques which have been developed. To enhance economic gains and to improve processing conditions, substitution of an alternative mineral acid and an alternative oxidizing agent has been considered. (auth)

18773 NLCO-782
National Lead Co. of Ohio, Cincinnati.
DEVELOPMENT OF A PROCESS FOR NITRIC ACID DIGESTION OF BELGIAN CONGO PITCHBLENDE. William C. Manser, Carl W. Huntington, Joseph R. Nelli, and Robert H. Ellerhorst. Nov. 6, 1958. 26p. Contract AT(30-1)-1156. $1.00(OTS).

The extreme reactivity of Belgian Congo pitchblende (Q-11) with concentrated nitric acid, which is used in the National Lead Company of Ohio ore digestion operation, motivated investigations aimed at developing methods of predigestion treatment which would reduce the digestion activity of this ore. Treatment with various oxidizing agents proved to be ineffective. From the laboratory investigations, a two-stage digestion procedure was developed which involved first, reaction with dilute nitric acid, followed by treatment with concentrated nitric acid. This alternative digestion procedure was successfully tested on a plant basis and was subsequently adopted for routine production digestion of Q-11. (auth)

18774 RDB(W)/TN-13
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE RECOVERY OF URANIUM FROM SPRINGFIELDS SLAG. PART 3. MULTIPLE LEACHING OF SLAG WITH SULPHURIC ACID. D. R. Terrey and W. D. Jamrack. Jan. 4, 1952. 6p.

With two typical samples, six leaches will remove 98% of the uranium from calcium slag and 95% from magnesium slag. In each experiment the whole of the leached residue was dissolved and evaporated to dryness for determination of the uranium content. (C.J.G.)

18775 RDB(W)/TN-20
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
AN IMPROVED SAMPLER FOR THE URANIUM PURIFICATION PLANT (B 207). T. I. M. Crofts. Feb. 26, 1952. 12p.

Investigations of hypodermic needles for use in sampling aqueous and solvent streams in the Windscale uranium purification plant are reported. It was concluded that 0.041, 0.036, and 0.018 in. bore needles can be used satisfactorily. (J.R.D.)

18776 AEC-tr-3412
ENRICHMENT OF URANIUM ISOTOPES BY THE METHOD OF GAS CENTRIFUGATION. (Anreicherung der Uran-Isotope nach dem Gaszentrifugenverfahren.) Wilhelm Groth, Konrad Beyerle, Hans Ihle, Alexander Murrenhoff, Erich Mann, and Karl-Heinz Welge. Translation of Research Report No. 510 of the Ministry of Industry and Commerce, West German Publishers, Cologne–Opladen, 1958. 74p. $2.00(OTS).

The separation of U^{235} by gas centrifugation of UF_6 is reviewed. The first efforts were in 1941 when a centrifuge was constructed which gave a separation just below theoretical yield. Early work also included the rocking procedure in which an oscillating gas stream can be created between two chambers either by a suitable device from the outside or through the periodic change of rpm of two connected centrifuges spinning oppositely. An enrichment of 5.2% was achieved with four such chambers. Other modifications of the centrifugal principle are described such as the UZIII A and B. Also, experiments using hydrogen for stabilization in the enrichment of various isotopes including those of U are discussed. Apparatus and measuring methods are described. Results are discussed, and recommendations for further development of gas centrifuges are presented. Further experimentation resulted in the development of the ZG 3 and 5, the features of which are described. Chemical investigations of methods for UF_6 purification are also described as well as the preparation of perfluorinated lubricating oils. (J.R.D.)

Raw Materials

18777 AERE-R-2862
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE ANALYSIS AND RECOVERY OF URANIUM FROM LOW GRADE ORES. An account of the work of the Chemical Research Laboratory, Department of Scientific and Industrial Research, Teddington, from 1946 to 1952. T. V. Arden. May 1959. 55p. $1.12(BIS).

This review of uranium recovery from low-grade ores includes sections on analytical methods, radiometric analysis, solvent extraction and cellulose chromatography, siliceous ores, fundamental studies on leaching of uranium, alkaline leaching, hydrolysis of uranium and other metal salts, Witwatersrand gold ore tailings, anion exchange recovery of uranium, Davidite ores, Rum Jungle ores, and Springfields effluents and residues. (L.T.W.)

18778 ORNL-2720
Oak Ridge National Lab., Tenn.
RECOVERY OF THORIUM, URANIUM, AND RARE EARTHS FROM MONAZITE SULFATE LIQUORS BY THE AMINE EXTRACTION (AMEX) PROCESS. D. J. Crouse and K. B. Brown. Aug. 3, 1959. 63p. Contract W-7405-eng-26. $1.75 (OTS).

An economical two-cycle solvent extraction process has been developed on a bench scale for the separate recovery of thorium and uranium from monazite sulfate liquors. Thorium is extracted in the first cycle with a primary amine in hydrocarbon diluent and uranium in the second cycle with a secondary or tertiary amine in hydrocarbon diluent. The principal advantages of the process over conventional precipitation methods are the essentially complete recoveries of both thorium and uranium and the clean separation of these metals from each other and from rare earths and phosphate. The rare earths can also be recovered and separated from phosphate by amine extraction if desired. (auth)